From:	Pechulis, Kevin
To:	Share, David M CERG; Cashwell, James M CERG; Funderburg, Lisa A HOUS
Cc:	MORASH, MELANIE; White, Sarah
Subject:	Olin Chemical Superfund Site - Proposed Plan and Postcard for Virtual Meeting and Hearing
Date:	Tuesday, August 11, 2020 2:03:07 PM
Attachments:	Save-the-date postcard Olin Virtual Events Aug-Sept 2020.pdf Aug 2020 Olin Proposed Plan.pdf

Mr. Share, Mr. Cashwell, and Ms. Funderburg,

I understand that Melanie Morash, the RPM for the Olin Chemical Superfund Site in Wilmington, Massachusetts (Site), has already forwarded this information to you, but I wanted to follow-up with this e-mail with information about EPA's release of a Proposed Plan for the Site and the upcoming public information meeting on August 25, 2020 and formal public hearing on September 22, 2020. The Proposed Plan is also attached to this email for your information, and the Administrative Record and Proposed Plan are available on EPA's website at www.epa.gov/superfund/olin. Please use the contact information listed in the Proposed Plan for any questions about the meeting and hearing and for public comments.

Sincerely,

Kevin Pechulis

Kevin P. Pechulis
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U.S. EPA Region 1
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SAVE THE DATE

VIRTUAL MEETING & HEARING

The U.S. Environmental Protection Agency will hold a virtual informational meeting and virtual formal hearing on a **Proposed Cleanup Plan for the Olin Chemical Superfund Site** in Wilmington, MA. The plan outlines EPA's preferred approach for an interim action to remove ongoing sources of contamination in groundwater and a final action to address contamination in soil, sediments, and surface water.

Public Informational Meeting and Q & A

Tuesday • Aug 25, 2020 7:00 pm – 8:30 pm

Formal Public Hearing to Provide Oral Comments

Tuesday • Sept 22, 2020 7:00 pm – 8:30 pm

Visit EPA's website:

www.epa.gov/superfund/olin for information on how to participate in EPA's upcoming virtual events.

CC *Closed captioning provided.*

For more information about these meetings please contact:

SARAH WHITE

(617) 918-1026 or

tollfree 1 (888) 372-7341

EPA's Proposed Cleanup Plan will be available on the website after Monday, August 10, 2020. Comment period is August 26 - September 25, 2020.

To obtain a hard copy of the plan or to be added to the electronic mailing list email: white.sarah@epa.gov

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SAVE THE DATE

OLIN CHEMICAL SUPERFUND SITE VIRTUAL MEETING & HEARING

SUPERFUND

PROPOSED PLAN

Olin Chemical Superfund Site
Wilmington, MA

U.S. EPA | HAZARDOUS WASTE PROGRAM AT EPA NEW ENGLAND

THE SUPERFUND PROGRAM protects human health and the environment by locating, investigating, and cleaning up abandoned hazardous waste sites and engaging communities throughout the process. Many of these sites are complex and need long-term cleanup actions. Those responsible for contamination are held liable for cleanup costs. EPA strives to return previously contaminated land and groundwater to productive use.

CLEANUP PROPOSAL SNAPSHOT

The Proposed Plan for cleanup at the Olin Chemical Superfund Site (Olin Site or Site) in Wilmington, Massachusetts generally includes the following components of an interim cleanup action to address the major sources of contamination in groundwater, and a final cleanup action to address contamination in soil, sediments, and surface water:

- Construct and operate new extraction and treatment systems to remove Dense Aqueous Phase Liquid (DAPL) and highly contaminated groundwater to reduce the mass and further migration of Site contaminants in groundwater;
- Construct and operate a new extraction system to capture contaminated groundwater and Light Non-Aqueous Phase Liquid (LNAPL) flowing into the surface waters referred to as the East, South, and Off-Property West Ditch Streams, which includes multi-phase extraction (MPE) wells to extract groundwater, LNAPL, and soil vapor; and treat the recovered LNAPL via oil/water separation, the soil vapor via granular activated carbon (GAC), and the captured groundwater via the same treatment system as for highly contaminated groundwater;
- Construct and maintain caps and cover systems on areas of soil contamination that pose an unacceptable ecological risk on the Olin Corporation (Olin) property (Property);

continued on next page >

Virtual Informational Meeting:
Tuesday • August 25, 2020
beginning at 7 p.m.

Virtual Public Hearing:
Tuesday • September 22, 2020
beginning at 7 p.m.

closed captioning will be provided

The Environmental Protection Agency (EPA) will accept public comments during the 30-day public comment period, which runs from: Wednesday, August 26, 2020 to Friday, September 25, 2020

For presentations, documents and how to participate in the virtual events, go to: **www.epa.gov/superfund/olin**

KEY CONTACTS:

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EPA United States Environmental Protection Agency

August 2020

CLEANUP PROPOSAL SNAPSHOT (CONT.)

- Construct and maintain a multi-layer impermeable cap over the feature known as the “Containment Area” on the Property to prevent leaching and prevent unacceptable ecological risks;
- Excavate approximately 4,000 cubic yards of contaminated wetland soil and sediment and dispose of off-site at an appropriate approved facility, and restore the wetlands and floodplain as needed;
- Prevent future exposure to trimethylpentenes (TMPs) that may pose inhalation risks (via vapor intrusion) by requiring additional evaluations and/or mitigation measures such as vapor barriers or sub-slab systems as needed;
- Operate and maintain any new and existing remedy infrastructure components;
- Continue studies to close remaining data gaps, including an improved characterization of bedrock topography and further delineation of the horizontal and vertical extent of groundwater contamination;
- Evaluate long-term groundwater cleanup options, leading to the selection of a final cleanup plan for the Site;
- Implement land use restrictions (called “Institutional Controls”) to protect public health and the remedy where unrestricted use standards are not achieved; and
- Conduct long-term groundwater and surface water monitoring and periodic reviews, at a minimum, every five years to assess protectiveness of the remedy.

The terms *highly contaminated groundwater* or *groundwater hot spots* refer to groundwater containing a large portion of the overall mass of contaminants relative to the overall plume. Groundwater hot spots are areas of highly contaminated groundwater, containing significantly elevated concentrations of n-nitrosodimethylamine (NDMA) and other Olin Site contaminants.

The term *interim action* means a provisional or short-term cleanup effort that is taken in the intervening time that EPA gathers additional information to inform a final remedial action. The interim actions that EPA proposes defer selection of a final groundwater remedy for the Olin Site until the full nature and extent of the contamination in groundwater is understood and additional alternatives which address the full extent are evaluated. The proposed interim actions are necessary to begin restoration of groundwater and to prevent unacceptable risks from future exposure to Site groundwater while gathering additional information to select a final cleanup plan. Accordingly, the cleanup objectives for the interim action have been developed to prioritize reduction of exposure risk and reduction of contaminant mass through treatment. These objectives do not include attainment of specific remediation levels. Final cleanup levels will be selected as part of the final remedy determination for Site groundwater.

EPA’s proposed remedy for the Site, including construction, operations and maintenance (O&M), and long-term monitoring, is estimated to cost approximately $48 million. An estimated two to three years will be needed to design and construct both the interim action for groundwater (DAPL and groundwater hot spots) and the final action for LNAPL and surface water. The operational time for the DAPL and groundwater hot spot interim action is estimated to be eight years. A 30-year timeframe was used for O&M, monitoring, and cost estimation purposes for the LNAPL and surface water final action. The final action for soil and sediments is estimated to take approximately two years to design and implement. EPA's preferred cleanup option for the Site is summarized in this Proposed Plan. A more detailed discussion of the various cleanup alternatives may be found in the Feasibility Study (FS) report.[1]

YOUR OPINION COUNTS: OPPORTUNITIES TO COMMENT ON THE PLAN

EPA, the lead agency,[2] will be accepting public comments on this proposed cleanup plan from **Wednesday, August 26, 2020 through Friday, September 25, 2020**. EPA is seeking input on all the alternatives and the rationale for the preferred cleanup alternative. Additionally, new information or arguments that EPA learns during the public comment period could result in the selection of a final remedial action that differs from the preferred alternative proposed in this plan. You do not have to be a technical expert to comment. If you have a concern, suggestion, or preference regarding this Proposed Plan, EPA wants to hear from you before making a final decision on how to protect your community. Comments can be sent by mail, e-mail, or telephone. Oral comments can also be provided at the formal Public Hearing. EPA is also specifically soliciting public comment concerning its determination that the alternatives chosen are the least environmentally damaging practicable alternatives for protecting wetland and floodplain resources. If you have specific needs for the two virtual community events planned for the Site–the public Informational Meeting or the formal Public Hearing–or if you have questions about accessing the events on-line or questions on how to comment, please contact Sarah White, EPA's Community Involvement Coordinator.

Virtual Informational Meeting: Tuesday, August 25, 2020, beginning at 7 p.m.
EPA representatives will provide a presentation of the nature and extent of contamination at the Site, as well as an overview of the exposure risks and cleanup plan. EPA will answer questions.

Virtual Public Hearing: Tuesday, September 22, 2020, beginning at 7 p.m.
The purpose of the Public Hearing is for community members to verbally express their opinions on EPA's proposed cleanup plan. There will be a short EPA presentation followed by an opportunity for verbal comments. EPA will not respond to questions or comments during this hearing.

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[1] The FS report for the Olin Site consists of three volumes – *Volume 1, Operable Unit 1 & Operable Unit 2 Feasibility Study, Olin Chemical Superfund Site, 51 Eames Street, Wilmington, Massachusetts,* Olin Corporation, July 31, 2020 (FS report Volume I); *Volume II, Interim Action Feasibility Study, Olin Chemical Superfund Site, 51 Eames Street, Wilmington, Massachusetts,* Olin Corporation, August 3, 2020 (FS report Volume II); and Memorandum, *Volume III – Comparative Analyses, Feasibility Study Report, Olin Chemical Superfund Site, Wilmington, Massachusetts*, EPA, August 5, 2020 (FS report Volume III).
[2] EPA is the lead agency for Olin Chemical Superfund Site (Site) activities, and the Massachusetts Department of Environmental Protection (MassDEP) is the support agency. EPA, in consultation with MassDEP, will select a remedial action for the Site after reviewing and considering all information submitted during the 30-day public comment period held between August 26, 2020 and September 26, 2020.

HOW TO PARTICIPATE IN EPA'S VIRTUAL INFORMATIONAL MEETING AND PUBLIC HEARING:

Visit EPA's website: www.epa.gov/superfund/olin for information on how to participate in EPA's virtual events. A copy of EPA's presentation will be available on the Site webpage prior to the informational meeting.

Closed captioning will be available during the virtual informational meeting and formal hearing.

In accordance with Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the law that established the Superfund program, and 40 C.F.R. § 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Remedial Investigation/Feasibility Study, this document summarizes EPA's cleanup proposal. For detailed information on the cleanup options evaluated for use at the Site, see the Olin Chemical Superfund Site Feasibility Study report and other documents contained in the Site's Administrative Record, which are available for review online at: www.epa.gov/superfund/olin

A CLOSER LOOK AT EPA'S PROPOSED CLEANUP APPROACH

The draft Remedial Investigation (RI) report for Operable Unit (OU) 3, dated June 2019 (Draft 2019 OU3 RI Report), the RI report for OU1/OU2, dated July 2015 (2015 OU1/OU2 RI Report), and the Jewel Drive Dense Aqueous Phase Liquid (DAPL) Extraction Pilot Study Performance Evaluation Report, dated November 2014, summarize the nature and extent of contamination at the Site in Wilmington, Massachusetts. These documents, supplemented by two memoranda prepared by EPA entitled *Updates to OU1/OU2 RI Report Conclusions*, dated August 5, 2020, and *Updates to Draft OU3 RI Report Conclusions*, August 5, 2020, were used to prepare the FS report.

The Commonwealth of Massachusetts has classified groundwater in the area of the Site as a "high use and value" drinking water supply. The FS report, which identifies the full range of alternatives that EPA considered for the proposed cleanup, is EPA's first step in the cleanup of the aquifer. The FS report evaluated the efficacy of different cleanup alternatives to protect human health and the environment by preventing risk of exposure to Site-related contaminants in groundwater, surface water, indoor air, soil, and sediments. The cleanup was split into several components that address different locations within the Site and different contaminated media. Based upon the alternatives evaluated in the FS report, EPA's cleanup approach for the Olin Site consists of the following components:

Interim Action – Dense Aqueous Phase Liquid (DAPL) and Groundwater Hot Spots (GWHS)

EPA's preferred alternative for the interim DAPL and Groundwater Hot Spots cleanup is **Alternative DAPL/GWHS-3 – DAPL Extraction (Approx. 20 Wells)/Groundwater Hot Spot Extraction Targeting 5,000 nanograms/Liter (ng/L) NDMA (Approx. 6 Wells), On-Site Treatment at New Treatment System**, as described in the FS report, which includes the following:

- Construction and operation of a DAPL extraction system, conceptualized with four wells in the Off-Property Jewel Drive DAPL pool, four wells in the Containment Area DAPL pool, and 12 wells in the Main Street DAPL pool;

- Construction and operation of a groundwater extraction and treatment system, conceptualized with six wells targeting the 5,000 ng/L NDMA contour, to remove and treat the mass of contaminants in groundwater hot spots; and
- On-site treatment of extracted DAPL and hot spot groundwater in a new treatment system generally consisting of the following methodologies:

    - Treatment for DAPL:
        - Lime precipitation to remove metals, with subsequent dewatering and off-site disposal of the liquids and sludge materials;
        - Evaporation of the remaining water and off-site disposal of the residual solids; and
        - Additional treatment as described for highly contaminated groundwater, below;

    - Treatment for highly contaminated groundwater:
        - Influent equalization tank;
        - Hypochlorite flash mixer (a rapid mixer that uniformly distributes a treatment chemical) for oxidation and removal of metals (iron and manganese);
        - Breakpoint chlorination to treat ammonia;
        - Slow mix flocculation (a process by which fine particulates are caused to clump together) and lamella clarifier (a series of inclined plates on which particulates can settle) to remove solids;
        - Filter press for solids dewatering;
        - GAC to ensure clarity and ultra-violet (UV) transmittance, as well as remove volatile organic compounds (VOCs);
        - UV photo-oxidation for NDMA destruction; and
        - Discharge of treated water.

Final Action – Light Non-Aqueous Phase Liquid (LNAPL) and Surface Water (SW)

EPA's preferred alternative for the final LNAPL and Surface Water cleanup is **Alternative LNAPL/SW-3 – Demolition of Plant B, Multi-Phase Extraction (MPE) for LNAPL, Targeted Groundwater Extraction to Prevent Discharge to Surface Water, On-Site Treatment at New Treatment System**, as described in the FS report, which includes the following:

- An estimated three to five MPE wells installed within the LNAPL footprint, including beneath the Plant B building foundation to remediate LNAPL, the smear zone, and dissolved-phase Site contaminants that would otherwise impact East Ditch Stream;
- Treatment of recovered LNAPL and soil vapor via a skid-mounted treatment system that includes an oil/water separator to remove the LNAPL and vapor-phase GAC to treat the soil vapor;
- Off-site disposal of recovered LNAPL at an appropriate off-site permitted facility;
- Construction and operation of a new groundwater extraction and treatment system, with extraction wells along Off-Property West Ditch Stream, at locations upgradient (west and northwest) of the weir at the upstream location of South Ditch Stream, and midway along South Ditch Stream between the weir and discharge location where South Ditch Stream meets East Ditch Stream, to intercept and treat the overburden groundwater contaminant plume that impacts these streams;

- Re-routing of groundwater treated by Plant B from the three extraction wells along East Ditch Stream to the new groundwater treatment system (the same system as for the hot spot groundwater); and
- Decommissioning and demolition of the Plant B groundwater treatment system.

Final Action – Soil and Sediments (SED)

EPA's preferred alternative for the final Soil and Sediments cleanup is **Alternative SOIL/SED-2 – Containment Area Cap, Upland Soil Covers, Excavation with Off-Site Disposal and Restoration of Wetland Soil and Sediments, Limited Action for TMPs (Institutional Controls, including Vapor Intrusion Evaluations or Vapor Barriers/Sub-Slab Depressurization Systems)**, as described in the FS report, which includes the following:

- Placement of a permanent cap over the Containment Area, the design and footprint of which will be determined during the Remedial Design (RD) phase;
- Closure of the existing slurry wall equalization window by grouting in place;
- Placement of a soil or asphalt cover system over areas of shallow (0-1 foot [ft]) upland soil with concentrations of Site contaminants in excess of the proposed cleanup levels;
- Excavation of wetland soil and sediment (0-1 ft) with concentrations of Site contaminants in excess of the proposed cleanup levels;
- Post-excavation confirmatory sampling to document limits of impacts and confirm achievement of the Remedial Action Objectives (RAOs) and proposed cleanup levels; and
- Off-site disposal of all excavated material at an appropriate off-site permitted facility.

Included with the three cleanup actions described above are the following:

- Pre-design investigations (PDIs) and/or treatability studies during the RD process to:
    - determine the final number, location, and configuration of extraction wells and other remedial components;
    - determine appropriate locations for discharge of treated groundwater to surface water; and
    - facilitate the implementation of the chosen cleanup alternatives and map the precise extent of excavation limits;
- Restoration with hydric soil (wetland-type soil) and native vegetation, as needed, of any wetland or floodplain habitat altered by the remedial action, as well as restoration of any excavated or otherwise altered areas with clean, imported backfill to grade and re-vegetate with native vegetation to control erosion;
- Long-term maintenance and monitoring of any new and existing remedy infrastructure components;
- Long-term monitoring of the groundwater plume and surface water, to evaluate remedy effectiveness;
- Continued studies to close remaining data gaps, including an improved characterization of bedrock topography and further delineation of the horizontal and vertical extent of groundwater contamination;
- Evaluation of long-term groundwater cleanup options, leading to the selection of a final cleanup plan for the Site;
- Institutional Controls to 1) prohibit future residential use at the Olin property; 2) prohibit the use of groundwater in the OU3 groundwater study area (for example, for potable or irrigation purposes, or for industrial process water) unless it can be demonstrated to EPA, in consultation with the State, that such use will not pose an unacceptable risk to human health and the environment, cause further

migration of the groundwater contaminant plume, or interfere with the remedy;[3] 3) prevent disturbance of any engineered systems and any other new and existing remedy infrastructure components; 4) prevent contact with soil beneath cover systems; and 5) require either a vapor intrusion evaluation or vapor mitigation system be installed if a new building is constructed on the Olin property (examples of Institutional Controls include Notice of Activity and Use Limitation (NAUL), Grant of Environmental Restriction and Easement (GERE), town ordinance, advisories, building permit requirements, and other administrative controls); and

- Periodic five-year reviews to assess remedy protectiveness.

Estimated Cost

The estimated total present cost of this proposed cleanup plan, including construction, O&M, and long-term monitoring, is approximately $48 million. Costs for all alternatives are discussed in detail in the FS report, and summarized in **Table 1**, *Comparative Analyses of Remedial Alternatives*.

Potential Community Impacts

Construction of the groundwater treatment system is expected to have low impacts to the community, as the work will be conducted on the Olin property. Other impacts to the community will be minimized as much as possible via use of Best Management Practices (BMPs). These impacts include potential disruptions to the community from the increase in traffic during construction activities, potential inhalation of airborne contaminants during implementation of excavation activities and during transportation of materials to and from the Site, and potential dermal contact with contaminated materials during remediation activities, including soil and sediment excavation and off-site disposal. Engineering control measures such as spraying soil with clean water, covering soil-filled trucks during excavation activities and transportation, covering temporarily stockpiled soils or other materials at the Olin property, and otherwise handling wastes appropriately and in accordance with all applicable and appropriate requirements, will be used to control any resulting dust and mitigate other impacts. Particulate air monitoring will ensure that dust does not travel to nearby properties. During excavation, access to work areas will be restricted to Site workers only. The cleanup work will be performed during typical work hours to minimize noise and traffic in nearby residential areas. It is anticipated that approximately two to three years will be needed to design and construct the Site remedy, including the final excavation/cover remedy for soil and sediments. It is estimated that the interim remedy for groundwater will operate for approximately eight years. A 30-year timeframe was used for O&M, monitoring, and cost estimation purposes for the LNAPL and surface water final action. Groundwater restrictions are expected to be in place until cleanup levels are achieved.

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[3] The Institutional Controls for groundwater will be applied to the area generally presented in **Figure 9**, OU3 Groundwater Study Area and Extent of Groundwater Institutional Controls, but may be modified (expanded or decreased) based on new data or information (for example, nature of use of proposed well) and will be effective until final groundwater cleanup goals are selected and achieved in the final remedy for the Site.

EPA IS REQUESTING PUBLIC COMMENTS ON THE FOLLOWING PROPOSED DETERMINATIONS:

Impacts to Wetlands and Floodplains

Section 404 of the Clean Water Act (CWA), federal regulations at 44 C.F.R. Part 9, and Executive Order 11990 (Protection of Wetlands) require a determination that there is no practicable alternative to taking federal actions in waters of the United States or wetlands. Should there be no practicable alternative, the federal actions should minimize the destruction, loss, or degradation of these resources and preserve and enhance their natural and beneficial values. Through analysis of the alternatives, EPA has determined that because of the existence of wetlands at this Site (see Figure 8, *Conceptual plan for Alternative SOIL/SED-2*,) and the levels of Site-related contamination that exists in these wetlands or in groundwater beneath these wetlands, there is no practicable alternative to conducting work in these areas. Extraction wells, piping, and temporary (but possibly permanent) access roads will need to be installed in the Maple Meadow Brook (MMB) wetlands to address contaminated groundwater beneath the wetlands. As required by the CWA, EPA has determined, through its analysis of the various alternatives, that the proposed cleanup alternatives (Alternatives DAPL/GWHS-3, LNAPL/SW-3, and SOIL/SED-2) are the least environmentally damaging practicable alternatives for protecting wetland resources. EPA will minimize potential harm and avoid adverse impacts to wetlands by using Best Management Practices (BMPs) during excavation and other remedial activities to minimize harmful impacts on the wetlands, wildlife or habitat, and by restoring these areas consistent with federal and state wetlands protection laws. Remedial work will include only those disturbances of wetland areas that are unavoidable to implement the alternatives. Wetlands will be restored and/or replicated nearby consistent with the requirements of federal and state wetlands protection laws. Wetland areas will be restored with native vegetation as a wetland area, and such restoration will be monitored until the wetland vegetation becomes re-established. Other mitigation measures will be used to protect wildlife and aquatic life during remediation, as necessary.

Before EPA can select a cleanup alternative, Executive Order 11988 (Floodplain Management) and federal regulations at 44 C.F.R. Part 9 require EPA to make a determination that there is no practicable alternative to activities that affect or result in the occupancy and modification of the 100- and 500-year floodplain. Through its analysis of alternatives, EPA has determined that the proposed cleanup will likely result in temporary occupancy of the 100-year floodplain and the 500-year floodplain (which is much smaller) in the MMB wetlands, but after completion of work there will not be any net loss of flood storage capacity. Additionally, based on the available data, EPA has determined that the proposed cleanup will not result in the occupancy and modification of the 500-year floodplain at the Olin property. A stormwater study will be undertaken as part of the pre-design investigations (PDIs) to confirm that this is the case. If impacts to the 500-year floodplain are found to be unavoidable, in addition to the likely temporary impacts to the 100-year floodplain, while implementing the cleanup actions, appropriate measures will be incorporated into the cleanup design and subsequently implemented during the Remedial Action (RA) phase to ensure that current flood storage capacities and any adjacent wetlands are not diminished after completion of the proposed remedial actions. BMPs will be used during the construction phase, which include erosion control measures, proper regrading, and restoration and monitoring of impacted areas. More detail regarding wetland and floodplain management can be found in the FS report.

Through this Proposed Plan, EPA is specifically soliciting public comments concerning its determination that the proposed cleanup alternatives are the least environmentally damaging practicable alternatives for protecting Site wetland resources and that EPA's proposed cleanup plan is protective of floodplain resources.

SITE DESCRIPTION AND HISTORY

Site Description

The Site is comprised of the Olin property, an approximately 50-acre parcel located within an industrial park at 51 Eames Street in Wilmington, Massachusetts (see **Figure 1,** *Area map*) and adjoining off-Property areas that have been impacted by contaminant releases from manufacturing and waste disposal activities formerly conducted at the Property (see, for example, **Figures 2 through 4**, discussed further in the sections below). A chemical manufacturing facility (Facility) was located within the 30-acre northern portion of the Property, which manufactured specialty chemicals for the rubber and plastics industries beginning in 1953 until the facility ceased operations in 1986. With the exception of the "Calcium Sulfate Landfill" feature in the southernmost end of the Site (see *Site History,* below), the 20-acre southern portion of the Property remains wooded and has been placed into a conservation easement. On-site waste disposal practices have resulted in groundwater contamination both on- and off-Property.

Site History

During past ownership, manufacturing and waste disposal activities resulted in environmental contamination impacting on-Property soil, sediments, surface water, and groundwater, and ultimately off-Property surface water, sediments, and groundwater as well. Process waters and liquid wastes with high concentrations of dissolved inorganic chemicals were discharged to unlined excavations in the native soil (e.g., "acid pits," see **Figure 2**, *Olin property features (current and historic)*, below; later, lined lagoons were used). The wastes percolated into the soil or overflowed into on-Property drainage features until the early 1970s when a treatment plant was installed. As the liquid materials moved downward through the soil, they reached the groundwater table – because the liquids were denser than water, they continued to sink downward (as DAPL) through the groundwater column, pooling in a series of cascading bedrock depressions via density-driven gravity flow (see **Figure 1**, *Area map*) – one on-Property pool (the "Containment Area" DAPL pool) and two off-Property pools (the "Jewel Drive" or "Off-Property West Ditch" DAPL pool and the "Main Street" DAPL pool).

Ultimately, contaminated groundwater was influenced by the Town of Wilmington's five municipal wells, located in the Maple Meadow Brook (MMB) aquifer to the west of the Property. DAPL has seeped into the underlying bedrock fractures but the extent of DAPL currently present within open bedrock fractures remains unknown. After Olin initiated closure of the Property in 1986, the chemical manufacturing buildings were demolished and removed. Closure activities included closure of the lined lagoons and excavation of Lake Poly, which was a prominent disposal location that is believed to have contributed to the formation of DAPL.

Since 1987, Olin has conducted environmental investigations and remedial actions under MassDEP oversight to understand the nature of environmental impacts at the Site and to address the risks posed by the Site. These investigations and subsequent remedial actions have resulted in the excavation and off-site disposal of soil from the former Lake Poly, two Drum Disposal Areas, a Buried Debris Area, sediment from the On-Property West Ditch Stream and associated wetlands, South Ditch Stream, and Central Pond. Soil and sludges from these areas were also placed on the southernmost portion of the Property in what has become known as the "Calcium Sulfate Landfill." A closure certification for the landfill was issued by MassDEP on January 7, 2009, which included requirements for post-closure monitoring.

An area of TMPs in soil and shallow groundwater associated with a petroleum spill was identified near a facility building known as "Plant B." This area was remediated using an air sparging/soil vapor extraction (AS/SVE) system. The AS/SVE system was closed and partially removed subsequent to approval by MassDEP. Additional detail on these soil and sediment remedial actions can be found in the 2015 OU1/OU2 RI Report and the FS report.

Since 1981, Olin has operated a groundwater recovery/treatment system ("Plant B") to address a petroleum spill (see preceding discussion) and prevent the subsequent seepage of LNAPL into East Ditch Stream, located at the eastern perimeter of the Property. The LNAPL is a process oil that contains bis-2-ethylhexylphthalate (BEHP), n-nitrosodiphenylamine (NDPA), and TMPs. Groundwater extracted during operation of the system is treated to remove iron and ammonia, as well as dissolved organic compounds. The treated groundwater is discharged in batches to surface water in On-Property West Ditch Stream, in compliance with a Remediation General Permit (RGP).

In 2000-2001, Olin constructed a slurry wall and cap around the on-Property portion of the most upgradient DAPL pool. This area is referred to as the "Containment Area" or "Containment Area DAPL Pool." The intent of this action was to eliminate, to the extent feasible, on-Property DAPL as a source of dissolved constituents to groundwater. The Containment Area is comprised of a 3-ft thick perimeter slurry wall installed to the top of weathered bedrock (approximately 100 to 40 ft below ground surface [bgs]) and a temporary cap to minimize infiltration of precipitation. Because the temporary cap is not fully impermeable, a 40-ft long pressure-equalization window was notched out of a portion of the wall along the northeast (upgradient) side to allow the free movement of shallow groundwater into and out of the Containment Area.

In October 2002, the Town of Wilmington ceased use of four of its five municipal drinking water wells in the MMB aquifer due to the detection of Site-related contaminants in the wells. In April 2003, the use of the fifth well, known as the Town Park Well, was voluntarily suspended by the Town of Wilmington's Water Department. Due to the contamination, the Town shifted its water source to four wells located outside of the area impacted by the Site. Olin and the other Potentially Responsible Parties (PRPs) subsequently funded construction of a new pipeline extension to the Massachusetts Water Resources Authority (MWRA). The constructed pipeline has been in operation since 2008.

In September 2005, EPA identified the Site as a Proposed Site for the National Priorities List (NPL). The primary hazardous substance used by EPA to score the Site was NDMA and the primary exposure pathway evaluated by EPA was groundwater. Currently, the Property is not in active industrial use. Olin maintains a small office trailer on the Property and continues to operate and maintain the Plant B groundwater remediation system.

Study Areas

The Site was finalized on the NPL in April 2006. To manage investigation and cleanup of the Site, EPA initially divided the Site into three OUs. OU1 consists of the Property, an approximately 50-acre parcel located at 51 Eames Street, including all media (soil, sediments, and surface water) on the former facility property, except for groundwater. OU1 includes the established conservation area in the southern portion of the Property, the on-Property stream system (East, South, and On-Property West

Ditch Streams), the Calcium Sulfate Landfill, and the Containment Area. Wastes disposed of on the Property caused surface water, sediments, and groundwater contamination both on- and off-Property.

OU2 consists of approximately three acres of soil, surface water, and sediment areas off-Property. This OU includes portions of East and South Ditch Streams, Off-Property West Ditch Stream, portions of the MMB wetlands, Landfill Brook, and North Pond.

OU3 consists of all groundwater, both on- and off-Property, and includes soil located below the water table (see **Figure 3**, *Olin Site contaminant plume in shallow overburden groundwater* and **Figure 4**, *Olin Site contaminant plume in deep overburden groundwater*). This OU includes groundwater beneath the Property, groundwater north, south, and east of the Property, groundwater west and northwest of the Property, including the MMB aquifer, and private residential wells in the overburden and bedrock aquifers.

Prior Cleanup Actions

As detailed above, investigations have been conducted at the Site by several parties since the mid-1970s. Olin became involved in the investigation and remedial activities at the Site after its purchase of the facility in 1980. In response to an EPA Site Inspection (SI) Report in 1980, Olin conducted response actions to mitigate and control migration of LNAPL at the Plant B area, which included the installation of the Plant B groundwater recovery/treatment system for LNAPL in 1981.

The Site was officially identified under the Massachusetts Contingency Plan (MCP) in a "Notice of Responsibility" letter from MassDEP on May 28, 1992. Investigations and environmental cleanup actions continued throughout the 1990s under the oversight of MassDEP. This history is summarized in a Focused Remedial Investigation (FRI) Report, prepared in October 2007.

In 2012, Olin completed the construction of a pilot extraction system for the Jewel Drive DAPL pool, designed to evaluate the feasibility of extracting DAPL from the aquifer. The pilot operated beginning in 2012 and was officially concluded in 2014, however, Olin continues to operate the DAPL extraction system to the present day on a voluntary basis. The pilot successfully demonstrated the feasibility of removing DAPL from where it is pooled on top of bedrock. Extraction in the Jewel Drive DAPL pool has removed approximately one million gallons of DAPL to date.

Current and Future Land Use

The Olin property is within a general industrial zone. The Site is not currently in use, except for activities to operate and maintain the Plant B groundwater recovery/treatment system and the Jewel Drive DAPL extraction program. Future land use on the northern 30 acres of the Property is expected to remain industrial. The southern 20 acres remain in a conservation easement. Residential properties are located along Main Street and Cook Avenue to the west of the Property, and along Eames Street before it intersects with Woburn Street. Site groundwater to the north and the west is classified as a public drinking water supply. The Town of Wilmington has ceased operation of all five of its municipal wells within the MMB aquifer due to the detection of NDMA and other chemicals attributed to the manufacturing and disposal activities that took place at the Olin Site. There are approximately 25 private drinking water wells in use near the Site (see section *Private Wells*).

Olin Chemical Superfund Site Timeline	
1952	Construction of the facility begins at the Olin Corporation (Olin) property (Property)
1953	Manufacturing of specialty chemicals for the rubber and plastics industries begins, with discharges of process waters and liquid wastes to unlined lagoons on the Property
Early 1950s	Natural drainages and wetland drainage complex modified
1975 to 1986	Discharges of wastes to unlined lagoons ceases; treatment plant constructed to treat liquid wastes; creation and operation of the Calcium Sulfate Landfill (CSL)
1980	Olin purchases the Property, continuing operations
1980	EPA issues a Site Inspection (SI) Report for the facility, focusing on water pollution control and Resource Conservation and Recovery Act (RCRA) compliance
1981	Installation and commencement of operations of the Plant B groundwater recovery/treatment system for Light Non-Aqueous Phase Liquid (LNAPL)
1986	Production ceases at the facility
1987	Closure of the CSL; environmental investigations and remedial activities by Olin begin
1986	Phase I SI Report for the facility prepared for the Massachusetts Department of Environmental Quality Engineering (MADEQE)
1992	Olin Chemical Superfund Site (Site) officially identified as a site subject to the Massachusetts Contingency Plan (MCP) in a Notice of Responsibility letter from the Massachusetts Department of Environmental Protection (MassDEP)
1993	Comprehensive Site Assessment (CSA) Report for the Site issued; CSA referred to as the "Phase II Comprehensive Site Assessment"
1994	Flocculant (floc) precipitate removed from the Off-Property West Ditch Stream via vacuum truck
1997	Supplemental Phase II Report issued and supplemental environmental investigations continue; response actions include sampling, risk assessments, and other remedial activities such as operation of the Plant B groundwater extraction and treatment system
2000	Air sparging/soil vapor extraction (AS/SVE) conducted, removing more than 2,000 pounds of trimethylpentenes (TMPs) from subsurface soils near Plant B; drums, debris, and impacted soil excavated from Drum Area A, Drum Area B, and the Buried Debris Area
2000 to 2001	Containment Area feature constructed with slurry wall and cap, encompassing the on-Property Dense Aqueous Phase Liquid (DAPL) pool; contaminated sediments from Upper South Ditch Stream (including the delta area), On-Property West Ditch Stream and associated wetland, and Central Pond excavated and disposed of off-site
2000 to 2004	Contaminated soil from the former Lake Poly area excavated and disposed of off-site
2002	Town of Wilmington ceases to use four of its five municipal drinking water wells in the Maple Meadow Brook (MMB) aquifer, due to the detection of Site-related contaminants in the wells
2003	Town of Wilmington voluntarily ceases to use its fifth (and final) well in the MMB aquifer – the Town Park Well
2005	EPA identifies the Site as a Proposed Site for the National Priorities List (NPL)
2006	EPA finalizes Site on the NPL
2006	EPA conducts first public meeting for the Site
2007 to present	EPA enters into an Administrative Settlement Agreement and Order on Consent (AOC) for a Potentially Responsible Party (PRP)-lead investigation with three of the PRPs for the Site
2007	Focused Remedial Investigation (FRI) Report issued to document existing Site conditions resulting from investigations and cleanups conducted under the MCP, and serve as a baseline for the Remedial Investigation (RI) Work Plan
2007	EPA conducts public meeting for the Site

2008	New drinking water line extension for the Town of Wilmington, connecting local residences to the Massachusetts Water Resources Authority (MWRA), funded by Olin and the other PRPs, and becomes operational; draft RI Work Plan submitted for EPA review; draft and final DAPL Pilot Design Reports are issued; EPA conducts public meeting for the Site
2008	Interim Response Steps Work Plan (IRSWP) issued to manage the ongoing operation and maintenance of the Plant B groundwater extraction and treatment system and the Containment Area, and to require the design, construction and operation of a DAPL field pilot extraction system
2009	Revised/Final RI Work Plan approved by EPA
2009 to 2013	Field work for Operable Unit (OU) 1 and OU2 conducted
2009 to present	Field work for OU3 conducted and ongoing; additional groundwater contamination discovered near well GW-413, indicating migration of contamination further north than previously understood
2009	Quarterly testing of private wells implemented, with first detections of NDMA in private wells on Cook Avenue; EPA conducts public meeting for the Site
2010	Olin agrees to provide bottled water to two private well owners on Cook Ave; EPA conducts public meeting for the Site; State issues Groundwater Use and Value Determination
2011	EPA issues Engineering Evaluation and Cost Analysis (EE/CA) Approval Memorandum for private wells; EPA conducts public meeting for the Site
2012	Construction of DAPL pilot extraction system is complete and system begins operation; Draft and Final EE/CA Work Plans are issued to evaluate alternatives for private wells
2013	Supplemental RI Work Plan revised and finalized
2013	Draft OU1/OU2 RI Report submitted to EPA for review
2014 to present	Official DAPL pilot concludes; Olin continues to operate the DAPL extraction system on a voluntary basis, removing more than one million gallons of DAPL to date
2014	Revised Draft OU1/OU2 RI Report submitted to EPA for review; EPA conducts public meeting for the Site
2015	Final OU1/OU2 RI Report submitted
2015	Original OU3 Data Gaps Work Plan issued
2019	Revised OU3 Data Gaps Work Plan issued
2019	EPA adds Site to Administrator's Emphasis List (AEL); EPA conducts public meeting for the Site
2020	Feasibility Study (FS) report issued, evaluating alternatives for an interim cleanup action for DAPL and groundwater hot spots and a final cleanup action for soil, sediments, surface water, and indoor air; EPA issues Proposed Plan for public comment

WHY CLEANUP IS NEEDED

EPA has determined that there are both current and future potential threats to human health and the environment at the Site due to its history of chemical manufacturing, disposal practices, and related spills. Waste disposal practices primarily included discharge of process waters and liquid wastes to unlined excavations (e.g., "acid pits"). This is thought to have contaminated upland soil and wetlands on the Property; overflow from the unlined lagoons resulted in contamination in surface water and sediments in the on-Property stream system and off-Property surface water features. The liquid wastes in the unlined lagoons sank downward as DAPL and pooled on the top of bedrock, migrating to the west and northwest and seeping into underlying bedrock fractures. The presence of metals (primarily chromium), BEHP, TMPs, as well as other contaminants, have been identified throughout soil and sediments at the Site at levels that present unacceptable risk to human health and the environment. Chromium, ammonia, and PAHs, including benzo(a)pyrene, have been identified at unacceptable levels in surface water. A variety of contaminants, most notably NDMA, chromium, and ammonia, continue to impact groundwater throughout the Site. The highest concentrations of these chemicals are found in the DAPL material, which has pooled on top of bedrock and seeped into underlying bedrock fractures. NDMA has also been found in nearby private residential wells at low concentrations. These wells are tested quarterly to confirm that levels of NDMA remain within EPA's acceptable risk range (see the sections *How is Risk to People Expressed?* and *Private Wells*, below).

At the Olin Site, the mass of NDMA and other Site contaminants contained within DAPL and groundwater hot spots represent an ongoing source of contamination to the surrounding aquifer. While additional groundwater data, and in particular data from the bedrock aquifer, is needed to develop a final remedy for groundwater, EPA believes that sufficient data exists to support an interim cleanup action to address the major, uncontrolled sources of contamination at the Site – DAPL and groundwater hot spots. These sources of contamination will first be addressed through the proposed interim actions for groundwater, during which time additional data will be collected. This additional information, combined with an evaluation of the success of the interim actions, will be used to develop an RI/FS and final cleanup plan for OU3 (groundwater).

Site Contaminants

The main contaminants related to the Olin Site (Site contaminants) include, but are not limited to, the following:

- A semi-volatile organic compound (SVOC) called **NDMA**, the primary Site contaminant that drives human health risks. SVOCs are a subset of organic chemicals. NDMA is present in very high concentrations in groundwater and in DAPL–levels of over 20,000 ng/L. There is no record of NDMA being used at the Site. It is thought to have formed *in-situ* from precursor chemicals including acetaldehyde, formaldehyde, and hydrazine;
- The inorganic compound **ammonia**, which is manufactured industrially and also produced naturally from bacterial processes and the breakdown of organic matter. Ammonia is present in groundwater and surface water at the Site;
- **Metals**, which naturally occur as minerals in soil and rock and are often present in wastewaters from industrial activities. Metals in environmental media may also be mobilized by industrial activities or releases. Metals present in soil and groundwater at the Site include **arsenic**, **chromium, cobalt,** and **manganese**, of which chromium is the most widespread;
- **Polycyclic aromatic hydrocarbons (PAHs)**, which are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, and other organic substances like tobacco or charbroiled meat. Several PAHs, including **benzo(a)pyrene**, are present in soil and surface water at the Site;
- A phthalate chemical called **BEHP**, detected in soils in certain areas;
- A type of VOC called **TMPs**, detected in soils in certain areas. VOCs are types of chemicals that can easily evaporate, generally used in products such as glues, paints, and solvents; and
- **LNAPL**, a mixture of process oil and other raw materials historically stored and used at the Facility that contains various contaminants, including **TMPs** and **BEHP.** LNAPL is present in soil and groundwater in the Plant B area in the northeastern portion of the Property.

HOW ARE RISKS TO HUMAN HEALTH EXPRESSED?

Every person has a baseline, non-site-related risk of developing cancer. For example, the American Cancer Society estimates that one in three men, and one in three women, will develop cancer over a lifetime (*Cancer Facts and Figures for 2019*, American Cancer Society). While people also have a baseline exposure to non-carcinogens (chemicals that may cause adverse effects other than cancer), these chemicals can result in toxic effects which are organ-specific, and therefore cannot be expressed in terms of probability. Therefore, in evaluating chemical exposure risk to humans, estimates for risk from carcinogens (chemicals that may cause cancer) and non-carcinogens are expressed differently.

For carcinogens, risk estimates are expressed in terms of probability. For example, exposure to a particular site-related carcinogenic chemical may present a 1 in 1,000,000 increased chance of causing cancer over an estimated lifetime of 70 years. This can also be expressed as one-in-a-million or 10^{-6} excess lifetime cancer risk. The EPA acceptable risk range for carcinogens is 10^{-6} (1 in 1,000,000) to 10^{-4} (1 in 10,000) in a 70-year lifetime. In general, site-related cancer risks in excess of this range are considered unacceptable under CERCLA and would require being addressed by the Superfund cleanup.

For non-carcinogens, exposures are first estimated using certain assumptions and then compared to an oral reference dose (RfD) for ingestion or a reference concentration (RfC) for inhalation. RfD and RfC values are toxicity values developed by EPA scientists based on human and/or animal studies as estimates of a daily exposure to a person, including the most sensitive person, that is likely to be without an appreciable risk of an adverse health effect when exposure occurs over the duration of a lifetime. The exposure dose or concentration is divided by the RfD or RfC value to calculate the ratio known as a hazard index (HI) for measuring whether non-cancer adverse health effects would likely occur or not. In general, HI values based on site-related exposure in excess of 1.0 are considered unacceptable and would require being addressed by the Superfund cleanup.

Exposure Pathways & Potential Risk

The presence of contamination does not necessarily mean there is a risk to people or the environment. There has to be exposure to a contaminant to have a potential risk. If there is no exposure, there is no potential risk. Exposure occurs when people or other living organisms eat, drink, breathe, or have direct skin contact with a hazardous substance or waste material. Based on existing or reasonably anticipated future land use at a site, EPA develops different possible exposure scenarios to determine potential risk, appropriate cleanup levels for contaminants, and potential cleanup approaches, all of which are documented in the FS.

Human health and ecological risk assessments were prepared to evaluate the risks to public health and ecological receptors from the Site. These conservative assessments evaluated different exposure scenarios to determine if and where there are current or potential future unacceptable risks to people and/or the environment.

Human Health Risks

People have the potential for exposure to Site contaminants through the following exposure pathways: drinking and direct contact with groundwater; inhalation of vapors emanating from soil contamination (in indoor air) and from groundwater contamination (during showering); and direct contact with soils and surface water. Further discussion of the exposure pathways is as follows:

- NDMA is toxic to the liver and a probable human carcinogen. NDMA in DAPL and groundwater hot spots poses potential unacceptable risks to residents through ingestion, dermal contact, and inhalation by showering via exposure from drinking water wells installed in the contaminant plume. EPA's health-protective risk range for NDMA is **0.47 to 47 ng/L**, based on EPA's acceptable cancer risk range of 10^{-6} (1 in 1,000,000) to 10^{-4} (1 in 10,000). NDMA is present in the aquifer with the highest concentrations of over **20,000 ng/L**;
- Metals and benzo(a)pyrene in soil could result in unacceptable risks to public health through ingestion, dermal contact, and inhalation of airborne dusts if residential-type or other sensitive-use buildings (e.g., a daycare) were to be constructed and occupied on the Olin property;
- TMPs in soil and LNAPL could result in unacceptable vapor intrusion risks to indoor workers and building occupants if commercial/industrial-type buildings were to be constructed and occupied on the Olin property. In this redevelopment scenario, if a complete pathway were to be created for TMP vapors from the subsurface to enter indoor air, unacceptable accumulations of TMPs could result in adverse health effects; and
- Benzo(a)pyrene in surface water in Off-Property West Ditch Stream could result in unacceptable risks to trespassers through dermal contact.

Private Wells

As noted above, 26 private residential wells are in use near the Site, screened within the bedrock contaminant plume. NDMA has been found in varying concentrations in these wells, with the majority of sampling events yielding non-detectable levels of NDMA. Eighteen wells are monitored regularly – on a quarterly basis – to confirm that levels of NDMA do not exceed **47 ng/L** (see *Human Health Risks,* above), which would result in unacceptable risk to human health based on cancer health effects. NDMA detections in 16 of these wells fall within EPA's health-protective range, with 72% of samples (438 out of 608 samples) showing non-detectable levels of NDMA. Two of the 18 wells have shown consistently higher levels of NDMA over time, with detections ranging from non-detectable to 33 ng/L. Sampling in the fall of 2017 yielded NDMA results of 56 and 57 ng/L in these two wells; all subsequent sampling results for these wells have been lower – ranging from non-detectable to 3.7 ng/L. Olin has provided bottled water to these two residences since 2010 and is in the process of working with the Town of Wilmington to voluntarily extend a waterline to these households.

The private well sampling data were evaluated to calculate the risk from consuming or otherwise having contact with the well water. Using conservative assumptions about the maximum level of NDMA a resident may be exposed to, a cancer risk of 3×10^{-5} (3 in 100,000) and an HI of 0.1 (see *How is Risk to People Expressed?*, above) was calculated – which meet EPA's health-protective criteria for NDMA. While the sampling results from the private wells over time have not shown an unacceptable risk, EPA recommends that no further wells be installed in this area because of the potential risks to public health and the threat of migration of NDMA that would be posed by additional wells. Therefore, EPA is including with this Proposed Plan a set of land use restrictions – "Institutional Controls" – that would prohibit the use of groundwater in the OU3 groundwater study area (for example, for potable or irrigation purposes, or for industrial process water) until final groundwater cleanup goals are selected and achieved in the final remedy for the Site, unless it can be demonstrated to EPA, in consultation with the State, that such use will not pose an unacceptable risk to human health and the environment, cause further migration of the groundwater contaminant plume, or interfere with the remedy (see Figure 9, OU3 Groundwater Study Area and Extent of Groundwater Institutional Controls).

Threats to the Environment

An ecological risk assessment was performed to evaluate the risk to ecological receptors potentially affected by the Site. The conclusions of the assessment were as follows:

- BEHP and chromium could result in adverse ecological impacts to the following:
    - songbirds (including the American Robin) and small mammals (including the Northern Short-Tailed Shrew) in upland soil;
    - invertebrate-eating songbirds (including the Marsh Wren) in wetland soil; and
    - insect-eating birds (including the Green Heron) in streambank soil and sediments;
- Site contaminants in sediments, likely including chromium, pose toxicity to aquatic organisms such as amphibians (including the Green Frog); and
- Chromium and ammonia could result in adverse ecological impacts to bottom-dwelling invertebrate species in surface water.

Principal Threat Waste

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP), which governs EPA cleanups, at 40 C.F.R. § 300.430(a)(1)(iii), states that EPA expects to use "treatment to address the principal threats posed by a site, wherever practicable" and "engineering controls, such as containment, for waste that poses a relatively low long-term threat" to achieve protection of human health and the environment. This expectation is further explained in an EPA fact sheet (OSWER[4] #9380.3-06FS), which states that principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Low-level threat wastes are source materials that generally can be reliably contained and that would present only a low risk in the event of exposure.

The concept of principal threat and low-level threat waste is applied on a site-specific basis when characterizing source material. Source material is defined as material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, air, or act as a source of direct exposure.

Although EPA has not established a threshold level of toxicity/risk to identify a principal threat waste, generally where toxicity and mobility combine to pose a cancer risk of 10^{-3} (one in one thousand) or greater, the source material is considered principal threat waste. NDMA-containing DAPL and groundwater hot spots pose an estimated cancer risk of 10^{-2} (1 in 100) and act as a continuing source of contamination to groundwater, and thus are considered to be principal threat wastes.

It is EPA's current judgment that the preferred alternatives identified in this Proposed Plan are necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances, including principal threat waste, into the environment and that treatment of the principal threat waste has been included as a component of the preferred alternative to the extent practicable.

[4] OSWER stands for *Office of Solid Waste and Emergency Response.*

CLEANUP ALTERNATIVES CONSIDERED

Once possible exposure pathways and potential risks have been identified at a site, cleanup alternatives are developed to reduce and/or mitigate the identified unacceptable risks and achieve the site-specific Remedial Action Objectives (RAOs), which are also known as the cleanup objectives. The RAOs for the Olin Site are as follows:

Interim Action – DAPL and Groundwater Hot Spot RAOs

- DAPL
  - Reduce, to the extent practicable, the volume of DAPL and mass of Site contaminants in DAPL that represent a source to groundwater, surface water, and sediments.
  - Reduce, to the extent practicable, the horizontal and vertical migration of DAPL acting as a source of Site contaminants, including penetration into bedrock.
  - Prevent potential human exposure by a future resident to DAPL containing Site contaminants at levels that pose an unacceptable risk.
- Groundwater Hot Spots
  - Reduce, to the extent practicable, the mass of Site contaminants in highly contaminated groundwater (groundwater hot spots).
  - Reduce, to the extent practicable, the further horizontal and vertical migration of Site contaminants in groundwater hot spots, including penetration into bedrock.
  - Prevent potential human exposure by a future resident to groundwater containing Site contaminants at levels that pose an unacceptable risk.

Final Action – LNAPL and Surface Water RAOs

- LNAPL
  - Prevent migration of LNAPL to East Ditch Stream to prevent exposure by current and future ecological receptors to Site contaminants that would result in potential adverse impacts.
  - Remove, to the extent practicable, LNAPL that represents a source of Site contaminants to groundwater and a source of TMPs to indoor air vapors, via a vapor intrusion pathway, that pose an unacceptable risk to future indoor workers or building occupants.
- Surface Water
  - Prevent migration of groundwater containing Site contaminants to East Ditch Stream, South Ditch Stream, and Off-Property West Ditch Stream to prevent exposure by current and future ecological receptors to surface water containing Site contaminants that would result in potential adverse impacts.
  - Prevent migration of groundwater containing Site contaminants to Off-Property West Ditch Stream to prevent potential human exposure by a current or future trespasser to surface water containing Site contaminants at levels that pose an unacceptable risk.

Final Action – Soil and Sediments RAOs

- OU1/OU2 Soil
  - Prevent potential human exposure by a future resident to soil containing Site contaminants at levels that pose an unacceptable risk.
- Upland Soil (including the Containment Area)

  - Prevent potential human exposure by a future indoor worker or building occupant to indoor air vapors, via a vapor intrusion pathway, containing Site contaminants at levels that pose an unacceptable risk.
  - Prevent exposure by current and future ecological receptors to upland soil containing Site contaminants that would result in potential adverse impacts.
  - Prevent leaching of Site contaminants associated with the Containment Area into groundwater, surface water, and sediments at levels that pose unacceptable risks to human health and the environment.
- Wetland Soil and Sediments
  - Prevent exposure by current and future ecological receptors to wetland soil and sediments containing Site contaminants that would result in potential adverse impacts.
  - Prevent the further migration of wetland soil and sediments containing Site contaminants to nearby wetlands, surface water, drainage features, and adjoining properties that would result in potential adverse impacts.

Table 2, *Proposed Cleanup Levels and Performance Standards to Address Human Health Risks* and **Table 3**, *Proposed Cleanup Levels and Performance Standards to Address Ecological Risks,* below, present the proposed Site contaminant cleanup levels and the basis for selection, for each exposure scenario described above found to pose an unacceptable risk to human health or the environment.

The following cleanup alternatives for DAPL and Groundwater Hot Spots, LNAPL and Surface Water, and Soil and Sediments were developed to address the identified unacceptable risks and achieve the site-specific RAOs (preferred alternatives underlined):

Interim Action – DAPL and Groundwater Hot Spot Alternatives

Alternative DAPL/GWHS-1: No action

Capital Cost	$0
Annual O&M Cost	$0
Present Worth Cost	$0
Construction Time	0 years
Time to Achieve RAOs	Not achieved

- As a baseline to compare against other alternatives, no action would be taken to address contamination in DAPL and groundwater hot spots. No construction would take place, and RAOs would not be achieved.

Alternative DAPL/GWHS-2: DAPL extraction (approx. 5 wells), groundwater hot spot extraction targeting 11,000 ng/L NDMA (approx. 2-3 wells), on-site treatment at new treatment system

Capital Cost	$10.3 million
Annual O&M Cost	$21.7 million
Present Worth Cost	$22.5 million
Construction Time	2-3 years
Time to Achieve RAOs	20 years

- Construction and operation of a DAPL extraction system, conceptualized with one well in the Off-Property Jewel Drive DAPL pool, one well in the Containment Area DAPL pool, and three wells in the Main Street DAPL pool;
- Construction and operation of a groundwater extraction system, conceptualized with two-three wells targeting the 11,000 ng/L NDMA contour, to remove and treat the mass of contaminants in groundwater hot spots in the areas downgradient of the Main Street DAPL pool; and
- On-site treatment of extracted DAPL and hot spot groundwater in a new treatment system.

Alternative DAPL/GWHS-3: DAPL extraction (approx. 20 wells), groundwater hot spot extraction targeting 5,000 ng/L NDMA (approx. 6 wells), on-site treatment at new treatment system

Capital Cost	$15.6 million
Annual O&M Cost	$24.6 million
Present Worth Cost	$35.5 million
Construction Time	2-3 years
Time to Achieve RAOs	8 years

- EPA's preferred alternative, discussed previously in the document.

Alternative DAPL/GWHS-4: DAPL extraction (approx. 20 wells), groundwater hot spot extraction targeting 1,100 ng/L NDMA (approx. 12 wells), on-site treatment at new treatment system

Capital Cost	$19.3 million
Annual O&M Cost	$26.5 million
Present Worth Cost	$40.5 million
Construction Time	2-3 years
Time to Achieve RAOs	8 years

- Construction and operation of a DAPL extraction system, conceptualized with four wells in the Off-Property Jewel Drive DAPL pool, four wells in the Containment Area DAPL pool, and 12 wells in the Main Street DAPL pool;
- Construction and operation of a groundwater extraction system, conceptualized with 12 wells targeting the 1,100 ng/L NDMA contour, to remove and treat the mass of contaminants in groundwater hot spots; and
- On-site treatment of extracted DAPL and hot spot groundwater in a new treatment system.

Final Action – LNAPL and Surface Water Alternatives

Alternative LNAPL/SW-1: No action

Capital Cost	$0
Annual O&M Cost	$0
Present Worth Cost	$0
Construction Time	0 years
Time to Achieve RAOs	Not achieved

- As a baseline to compare against other alternatives, no action would be taken to address contamination from LNAPL and in surface water. No construction would take place, and RAOs would not be achieved.

Alternative LNAPL/SW-2: MPE for LNAPL with treatment at Plant B, groundwater extraction to prevent discharge of contaminants to surface water, on-site treatment at new treatment system

Capital Cost	$4.6 million
Annual O&M Cost	$6.5 million
Present Worth Cost	$9.0 million
Construction Time	2-3 years
Time to Achieve RAOs	30 years

- Construction and operation of one MPE well, located just outside of the northeast corner of the Plant B building near monitoring well GW-23, where the thickest LNAPL accumulation is observed;
- Use of an oil/water separator to remove LNAPL and GAC to treat vapors as part of the skid-mounted system, and conveyance of extracted groundwater to Plant B for additional treatment;
- Storage of extracted LNAPL on-site, with off-site disposal at an appropriate off-site permitted facility;
- Construction and operation of a groundwater extraction system, with extraction wells adjacent to East Ditch Stream, South Ditch Stream, and Off-Property West Ditch Stream, to intercept and treat the overburden groundwater contaminant plume that impacts these streams; and
- Treatment and discharge of extracted groundwater at a newly constructed, on-site, groundwater treatment system (the same system as for the hot spot groundwater).

<u>Alternative LNAPL/SW-3: Demolition of Plant B, Expanded MPE for LNAPL, targeted groundwater extraction to prevent discharge to surface water, on-site treatment at new treatment system</u>

Capital Cost	$2.3 million
Annual O&M Cost	$7.4 million
Present Worth Cost	$6.6 million
Construction Time	2-3 years
Time to Achieve RAOs	30 years

- EPA's preferred alternative, discussed previously in the document.

Alternative LNAPL/SW-4: Excavation of LNAPL with off-site disposal, Targeted Permeable Reactive Barriers (PRBs) to treat groundwater before discharge into surface water

Capital Cost	$5.3 million
Annual O&M Cost	$6.7 million
Present Worth Cost	$9.0 million
Construction Time	1 year
Time to Achieve RAOs	30 years

- Decommissioning and demolition of Plant B;
- Excavation of LNAPL-impacted soil to the bottom of the smear zone;
- Dewatering and stabilization of soil, as necessary;

- Post-excavation confirmatory sampling to document limits of soil impacts and confirm achievement of the RAOs;
- Off-site disposal of all excavated material at an appropriate off-site permitted facility;
- Construction and installation of PRBs along portions of South Ditch Stream, with a grouted sheet-pile wall to direct groundwater through the PRBs, the design of which will be based on additional data obtained during PDIs and may include additional segments of PRB in other areas to address East and West Ditch Streams;
- Construction and operation of a new groundwater extraction and treatment system, and re-routing of groundwater treated by Plant B from the three wells along East Ditch Stream to the new groundwater treatment system (the same system as for the hot spot groundwater); and
- Decommissioning and demolition of the Plant B groundwater treatment system.

Final Action – Soil and Sediment Alternatives

Alternative SOIL/SED-1: No Action

Capital Cost	$0
Annual O&M Cost	$0
Present Worth Cost	$0
Construction Time	0 years
Time to Achieve RAOs	Not achieved

- As a baseline to compare against other alternatives, no action would be taken to address contamination in the Containment Area, upland soil, wetland soil and sediments, and TMPs in soil. No construction would take place, and RAOs would not be achieved.

<u>Alternative SOIL/SED-2: Containment Area cap, upland soil covers, excavation with off-site disposal and restoration of wetland soil and sediments, limited action for TMPs (Institutional Controls, including vapor intrusion evaluation or vapor barriers/sub-slab depressurization systems)</u>

Capital Cost	$5.6 million
Annual O&M Cost	$1.1 million
Present Worth Cost	$6.1 million
Construction Time	2 years
Time to Achieve RAOs	2 years

- EPA's preferred alternative, discussed previously in the document.

Alternative SOIL/SED-3: Containment Area cap, excavation (0-1 ft) with off-site disposal and clean soil cover for upland soil, excavation with off-site disposal and restoration of wetland soil and sediments, air sparging and SVE for TMPs alternative

Capital Cost	$6.7 million
Annual O&M Cost	$1.5 million
Present Worth Cost	$7.5 million
Construction Time	2 years
Time to Achieve RAOs	2 years

- Placement of a permanent cap over the Containment Area;
- Closure of the existing equalization window by grouting in place;
- Excavation of upland soil from 0-1 ft with concentrations of Site contaminants in excess of the proposed cleanup levels;
- Backfilling of excavations with either a 1-ft soil layer cover system or a combination 9-in soil layer and 3-in asphalt layer cover system;
- Excavation of wetland soil and sediment (0-1 ft) with concentrations of Site contaminants in excess of the proposed cleanup levels;
- Installation and operation of an air sparging/SVE system to remove and treat TMPs in soil;
- Post-excavation confirmatory sampling to document limits of impacts and confirm achievement of the RAOs and proposed cleanup levels; and
- Off-site disposal of all excavated material at an appropriate off-site permitted facility.

Alternative SOIL/SED-4: Excavation (0-10 ft) with off-site disposal and clean soil cover for Containment Area and upland soil, excavation with off-site disposal and restoration of wetland soil and sediments, excavation and off-site disposal for TMPs alternative

Capital Cost	$34.0 million
Annual O&M Cost	$330,000
Present Worth Cost	$34.2 million
Construction Time	2 years
Time to Achieve RAOs	2 years

- Excavation of targeted areas within the Containment Area with concentrations of Site contaminants in excess of the proposed cleanup levels;
- Installation of sheet piling, as necessary, to maintain the structural integrity of the slurry wall during excavation;
- Excavation of upland soil from 0-10 ft with concentrations of Site contaminants in excess of the proposed cleanup levels;
- Excavation of wetland soil and sediment (0-1 ft) with concentrations of Site contaminants in excess of the proposed cleanup levels;
- Excavation of soil with TMP impacts in excess of the proposed cleanup levels;
- Dewatering and stabilization of soil, as necessary;
- Post-excavation confirmatory sampling to document limits of soil impacts and confirm achievement of the RAOs and proposed cleanup levels; and
- Off-site disposal of all excavated material at an appropriate off-site permitted facility.

The following components are also included with each of the above "action" (as opposed to "no action") alternatives:

- PDIs and/or treatability studies during the RD process to:
    - determine the final number, location, and configuration of extraction wells and other remedial components;
    - determine appropriate locations for discharge of treated groundwater to surface water; and
    - facilitate the implementation of the chosen cleanup alternatives and map the precise extent of excavation limits;

- Restoration with native vegetation any wetland or floodplain habitat altered by the remedial action, as well as restoration of any excavated or otherwise altered areas with clean (i.e., compliant with appropriate screening levels), imported backfill to grade and re-vegetate with native vegetation to control erosion;
- Long-term maintenance and monitoring of any new and existing remedy infrastructure components;
- Long-term monitoring of the groundwater plume and surface water, to evaluate remedy effectiveness;
- Continued studies to address remaining data gaps, including an improved characterization of bedrock topography and further delineation of the horizontal and vertical extent of groundwater contamination;
- Evaluation of long-term groundwater cleanup options, leading to the selection of a final cleanup plan for the Site;
- Institutional Controls to 1) prohibit future residential use at the Olin property; 2) prohibit the use of groundwater in the OU3 groundwater study area (for example, for potable or irrigation purposes, or for industrial process water) unless it can be demonstrated to EPA, in consultation with the State, that such use will not pose an unacceptable risk to human health and the environment, cause further migration of the groundwater contaminant plume, or interfere with the remedy; 3) prevent disturbance of any engineered systems and any other new and existing remedy infrastructure components; 4) prevent contact with soil beneath cover systems; and 5) require either a vapor intrusion evaluation or vapor mitigation system be installed if a new building is constructed on the Olin property; and
- Periodic five-year reviews to assess remedy protectiveness.

THE NINE CRITERIA FOR CHOOSING A CLEANUP PLAN

EPA uses nine criteria to evaluate cleanup alternatives and select a final cleanup plan. EPA has already evaluated how well each of the cleanup alternatives developed for the Olin Site meet the first seven criteria in the FS report. Once comments from the community and State are received and considered, EPA will select the final cleanup plan and document its selection in the Record of Decision (ROD) for the Site.

1. Overall protection of human health and the environment: Will it protect you and the plant and animal life on and near the site? EPA will not choose a cleanup plan that does meet this basic criterion.
2. Compliance with ARARs: Does the alternative meet all federal environmental and state environmental and facility siting statutes and regulations that are either applicable or relevant and appropriate to the selected cleanup plan? The cleanup plan must meet this criterion.
3. Long-term effectiveness and permanence: Will the effects of the cleanup plan last or could contamination cause future risk?
4. Reduction of toxicity, mobility, or volume (TMV) through treatment: Using treatment, does the alternative reduce the harmful effects of the contaminants, the spread of contaminants, and the amount of contaminated material?
5. Short-term effectiveness: How soon will site risks be adequately reduced? Could the cleanup cause short-term hazards to workers, residents, or the environment?
6. Implementability: Is the alternative technically feasible? Are the right goods and services (*i.e.* treatment equipment, space at an approved disposal facility) available?
7. Cost: What is the total cost of an alternative over time? EPA must select a cleanup plan that provides necessary protection for a reasonable cost.
8. State acceptance: Do state environmental agencies agree with EPA's proposal?
9. Community acceptance: What support, objections, suggestions, or modifications did the public offer during the comment period?

CLEANUP ALTERNATIVES COMPARISON

The alternatives for DAPL and Groundwater Hot Spots, LNAPL and Surface Water, and Soil and Sediments were compared to each other to identify how well each alternative meets EPA's evaluation criteria. The State and Community Acceptance criteria will be evaluated once feedback is received during the public comment period. The following discussion and Table 1, *Comparative Analyses of Remedial Alternatives*, present a general and cost comparison summary of the alternatives against EPA evaluation criteria for each cleanup component. Detailed evaluations and comparisons of alternatives are included in the FS report.

Interim Action – DAPL and Groundwater Hot Spots

Overall Protection of Human Health and the Environment

The No Action Alternative (DAPL/GWHS-1) provides no protection of human health or the environment. Alternatives DAPL/GWHS-2 through -4 are protective of human health and the environment. These alternatives remove uncontrolled DAPL sources, a major source of contamination to downgradient groundwater, and prohibit unauthorized use of contaminated groundwater as a drinking water source via Institutional Controls. Extraction and treatment of groundwater hot spots is included in these alternatives, which reduces risk to potential downgradient receptors by capturing highly contaminated groundwater that would otherwise migrate uncontrolled and that acts as a source of contamination.

Compliance with ARARs

The remedial action alternatives for DAPL and Groundwater Hot Spots are interim actions that will be evaluated against the RAOs specified above. As interim actions, these alternatives are not expected to attain chemical-specific ARARs, and thus cleanup goals have not been set for these groundwater actions based on chemical-specific ARARs. The achievement of chemical-specific ARARs in groundwater within the aquifer will be addressed in the final remedial action that addresses the restoration of groundwater. The proposed interim remedial actions for groundwater will support the final groundwater remedial action.

No activities would be performed under the No Action Alternative (DAPL/GWHS-1), therefore, action- and location-specific ARARs do not apply. With proper implementation, it is anticipated that Alternatives DAPL/GWHS-2 through -4 would meet action- and location-specific ARARs (see Tables 2.1-3 – 2.1-10 in the FS report Volume II). Action-specific ARARs would be met for the treatment and disposal/discharge of extracted DAPL and groundwater. Each alternative may have unavoidable impacts to wetlands and floodplains so that extraction wells and piping, and access roads and staging areas for such wells and piping, can be installed. However, these alternatives will comply with location-specific ARARs, which will require minimization of impacts and mitigation of damage to wetlands and floodplains impacted by well installation and piping, and restoration of flood storage capacities, if necessary, following completion of the proposed remedial activities.

Long-term Effectiveness and Permanence

The No Action Alternative (DAPL/GWHS-1) would not decrease the risks to human health and the environment. Alternatives DAPL/GWHS-2 through -4 rely on Institutional Controls to prevent exposure to contaminated groundwater and use groundwater hot spot and DAPL extraction to intercept the plume and remove source material, thus reducing contaminant toxicity and mobility. Of these three alternatives, Alternatives DAPL/GWHS-3 and -4 are expected to have good long-term effectiveness and permanence and would be more effective in the long-term than Alternative DAPL/GWHS-2, as the former will achieve the removal of an estimated 5% more DAPL (an estimated 14.8 million gallons of DAPL for Alternatives DAPL/GWHS-3 or -4 as compared to an estimated 14.1 million gallons of DAPL for Alternative

DAPL/GWHS-2) by using more extraction wells to reduce the number of isolated low points within the DAPL pools, which further reduces residual risk.

Alternative DAPL/GWHS-4 would be somewhat more effective in the long-term than Alternative DAPL/GWHS-3, which would be more effective than Alternative DAPL/GWHS-2, as Alternative DAPL/GWHS-4 targets the lowest groundwater NDMA concentrations (the 1,100 ng/L NDMA contour, versus the 5,000 ng/L NDMA contour targeted by Alternative DAPL/GWHS-3 and the 11,000 ng/L NDMA contour targeted by Alternative DAPL/GWHS-2) and thus leaves the smallest mass of contamination unaddressed and provides the most control over groundwater contaminant sources and migration.

Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

The No Action Alternative (DAPL/GWHS-1) does not include any treatment, and thus provides no reduction in TMV through treatment. All the remaining alternatives provide for treatment of DAPL and groundwater contamination. Of the three action alternatives, Alternatives DAPL/GWHS-3 and -4 provide for a greater reduction of contaminant TMV through treatment as compared to Alternative DAPL/GWHS-2 because more DAPL would be removed (an estimated 14.8 million gallons under Alternatives DAPL/GWHS-3 or -4 versus an estimated 14.1 million gallons under Alternative DAPL/GWHS-2), resulting in a smaller amount of DAPL remaining in the subsurface following extraction.

For the groundwater hot spots, Alternatives DAPL/GWHS-3 and -4 provide for the best reduction of contaminant TMV through treatment as compared to Alternative DAPL/GWHS-2. This is because under Alternatives DAPL/GWHS-3 and -4, a greater volume of contaminated groundwater will be removed and treated, thereby removing a greater mass of NDMA thereby removing a greater mass of NDMA from the overburden aquifer:

- Under Alternative DAPL/GWHS-3, an estimated 68.4 million gallons of groundwater will be removed, thereby removing an estimated 7,013 g of NDMA;

- Under Alternative DAPL/GWHS-4, an estimated 110.3 million gallons of groundwater will be removed, thereby removing an estimated 7,320 g of NDMA;

By contrast, under Alternative DAPL/GWHS-2, an estimated 17.1 million gallons of groundwater will be removed, thereby removing an estimated 4,159 g of NDMA.

Short-term Effectiveness

While the No Action Alternative (DAPL/GWHS-1) will not be effective in the short-term in protecting human health or the environment, because no remedial activities will occur, there will be no adverse impacts to the public or workers performing the cleanup, or the environment. Of the three action alternatives, the number of extraction wells increases under succeeding alternatives, with increasing impacts to the environment from well drilling and associated construction activities and piping installations (an estimated 7-8 wells, 26 wells, and 32 wells under Alternatives DAPL-GWHS-2, -3, and -4, respectively). All three include one or more extraction wells and piping in the MMB wetlands to collect hot spot groundwater, however, wells and piping would be installed in a manner so as to minimize impacts, and use of BMPs during the work would also serve to minimize environmental impacts in this sensitive area.

The estimated timeframe to remove DAPL under Alternative DAPL/GWHS-2 is approximately 20 years; under this alternative an estimated two to three years would be required to address the target NDMA groundwater concentration of 11,000 ng/L. The estimated timeframe to remove DAPL under Alternatives DAPL/GWHS-3 or -4 is approximately five years; under both alternatives an estimated seven to eight years would be required to address the target NDMA concentrations of 5,000 ng/L and 1,100 ng/L, respectively, inclusive of the five-year timeframe for DAPL removal. However, for these three alternatives, the risk of human exposure to DAPL and contaminated groundwater is expected to be addressed upon implementation of Institutional Controls.

Implementability

The No Action Alternative (DAPL/GWHS-1) is the easiest to implement because no remedial activities are required. The remaining alternatives all use standard construction equipment and there are no infrastructure issues; no issues are anticipated regarding the availability of treatment, storage, and disposal facilities (TSDFs) for waste solids and other treatment residuals. Alternatives DAPL/GWHS-2, 3, and 4 would all require access to private property to install extraction wells and conveyance pipes. DAPL and groundwater extraction is a reliable technology and allows for optimization, increasing the reliability.

Implementation of Alternatives DAPL/GWHS-3 and -4 would be more challenging because these alternatives require the placement of groundwater extraction wells directly above the DAPL pools to extract hot spot groundwater. Due to the geochemical properties of DAPL, the extraction of overlying hot spot groundwater must be implemented in a way that minimizes mixing, which could result in the precipitation of dissolved metals that foul the extraction well screens. Potential extraction sequencing and/or cycling strategies, and/or alternative well designs would need to be explored during the PDI phase and incorporated into the RD to improve the efficiency of groundwater hot spot extraction. Designs to be investigated would include, but are not limited to, the use of short-screened extraction wells to remove DAPL, designed to maximize the distance between the target intake depth and the DAPL/hot spot groundwater interface. A goal of the PDI would be to determine sufficient spacing between extraction wells to minimize the effects of pumping drawdown, which may allow multiple wells to operate simultaneously while minimizing disturbance of the DAPL and impacts to hot spot groundwater extraction. Positive outcomes would include the achievement of uniform decline in the DAPL pools and a shorter time for DAPL and hot spot groundwater recovery.

DAPL extraction has been implemented at the Site and proven effective and sustainable at a pumping rate of 0.25 gallons per minute (gpm), however, the feasibility of on-site DAPL treatment will require treatability (bench-scale) testing as part of a PDI. Planned monitoring of DAPL and groundwater hot spots will confirm system effectiveness. The additional extraction wells under Alternative DAPL/GWHS-4 (an estimated 32 wells total, as compared to an estimated 26 wells under Alternative DAPL/GWHS-3) may pose installation challenges. Overall, of the three action alternatives, Alternatives DAPL/GWHS-2 and -3 have high implementability, and the implementability of Alternative DAPL/GWHS-4 is somewhat lower.

Costs

The costs for all alternatives are presented in **Table 1**, *Comparative Analyses of Remedial Alternatives*, below. Except for the costs of the five-year reviews, there is no cost associated with the No Action Alternative (DAPL/GWHS-1). The overall costs for Alternatives DAPL/GWHS-2, -3, and -4 are $22.5 million, $35.5 million, and $40.5 million, respectively.

Final Action – LNAPL and Surface Water

Overall Protection of Human Health and the Environment

The No Action Alternative (LNAPL/SW-1) provides no protection of human health and the environment while the three action alternatives – LNAPL/SW-2, -3, and -4 – are protective of human health and the environment. Alternatives LNAPL/SW-2 and -3 both utilize MPE wells to extract LNAPL and contaminated groundwater, preventing the release of LNAPL into East Ditch Stream, as well as use groundwater extraction wells adjacent to East, South, and Off-Property West Ditch Streams, to intercept and treat the overburden groundwater contaminant plume that flows into these streams. Both alternatives include treatment to remove the LNAPL material and Site contaminants from groundwater to levels protective of the streams prior to discharge of extracted groundwater to surface drainage. Alternative LNAPL/SW-4 includes excavation and off-site disposal to completely remove the LNAPL, along with continued operation of the three extraction wells along East Ditch Stream until the new groundwater extraction and treatment system is operational, preventing further releases to East Ditch Stream. This alternative also includes the use of PRBs to treat groundwater in-situ to protective levels prior to groundwater flowing into streams. Short-term continued operation of Plant B is assumed for this alternative until the new groundwater hot spot treatment system is constructed and operational. At this point, groundwater extracted from the three wells along East Ditch Stream will be re-routed to the new groundwater treatment system. If Plant B were to be shut down prior to construction of the new treatment system, an evaluation of site hydrogeology would be performed first to ensure continued protection of human health and the environment, which might result in the identification of a need for additional extraction wells and/or PRB segments along East Ditch Stream.

Compliance with ARARs

All alternatives, except for the No Action Alternative (LNAPL/SW-1), have been developed to comply with ARARs. There are no chemical-specific ARARs for the LNAPL/SW alternatives. With proper implementation, it is anticipated that Alternatives LNAPL/SW-2 and -3 would meet action- and location-specific ARARs (see Tables 2.1-10 – 2.1-11 in the FS report Volume I and Tables 2.1-1 – 2.1-2 in the FS report Volume II). LNAPL will be removed to the extent practicable, and proposed site-specific ecological surface water performance standards derived from National Recommended Water Quality Criteria (NRWQC) will be used to monitor surface water to ensure that the groundwater extraction and treatment are successful in reducing contaminant levels in surface water to be protective of ecological receptors. Both alternatives would include treatment to remove the LNAPL material and Site contaminants from groundwater. Under these alternatives, the effluent from the treatment system will be treated prior to any discharges to streams. In addition, any impacts to wetlands from the construction of these systems will be mitigated, thus achieving location-specific ARARs.

With proper implementation, it is anticipated that Alternative LNAPL/SW-4 would also meet action- and location-specific ARARs (see Tables 2.1-10 – 2.1-11 in the FS report Volume I and Tables 2.1-1 – 2.1-2 in the FS report Volume II). This alternative includes excavation and off-site disposal to completely remove the LNAPL, along with continued operation of the three extraction wells along East Ditch Stream, preventing further releases to East Ditch Stream. Proposed site-specific surface water performance standards derived from NRWQC (to address ecological risks) and To-Be-Considered (TBC) guidance (to address human health risks) will be used to monitor surface water to ensure that the PRBs and extraction wells are successful in reducing contaminant levels in surface water to be protective of sensitive receptors. PRBs would also treat groundwater to protective levels prior to groundwater flowing into the streams. In addition, any impacts to wetlands from the construction of these systems will be mitigated (thus achieving location-specific ARARs).

Long-term Effectiveness and Permanence

The No Action Alternative (LNAPL/SW-1) would not decrease the risks to human health and the environment. Conversely, Alternatives LNAPL/SW-2 and -3 would both utilize MPE to remove LNAPL and remediate the smear zone. Under these alternatives, groundwater containing Site contaminants that would otherwise enter the streams would be permanently removed and treated. Both alternatives would result in some residual risk as neither can remove all LNAPL from soil pores and LNAPL sorbed to soil particles. However, Alternative LNAPL/SW-3 would be more effective in the long-term with an estimated three to five MPE wells versus an estimated one well under Alternative LNAPL/SW-2, as the expanded MPE system under Alternative LNAPL/SW-3 would remove more of the LNAPL that is located under the Plant B building and result in less residual risk. Under Alternative LNAPL/SW-3, approximately 90% of an estimated 12 gallons of mobile (floating) LNAPL would be removed. By contrast, under Alternative LNAPL/SW-2, approximately 65% of the mobile LNAPL would be removed. Alternative LNAPL/SW-4 would be the most effective in the long-term, as nearly all residual LNAPL would be removed by excavation.

The MPE and groundwater extraction and treatment systems in Alternatives LNAPL/SW-2, -3, and -4 would permanently remove and treat groundwater containing Site contaminants that would otherwise enter the streams. For Alternative LNAPL/SW-4, the PRBs would convert the contaminants to less toxic contaminants. Except for the No Action Alternative (LNAPL/SW-1), all alternatives include Institutional Controls to prevent exposure while the remedy is implemented.

Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

The No Action Alternative (LNAPL/SW-1) does not include any treatment, and thus provides no reduction in TMV through treatment. Alternatives LNAPL/SW-2 and -3 provide for a permanent removal of Site contaminants in groundwater through treatment. Alternative LNAPL/SW-4 includes the excavation of 390 tons of soil. This soil will not be treated and may require disposal as hazardous waste. This alternative also utilizes PRBs and the three existing extraction wells along East Ditch Stream to treat groundwater, reducing its toxicity, prior to discharge into streams. If Plant B were to be shut down prior to construction of the new groundwater treatment system, an evaluation of site hydrogeology might result in the identification of a need for additional extraction wells and/or PRB segments along East Ditch Stream. Overall, Alterative LNAPL/SW-3 provides for the greatest reduction of contaminant TMV through treatment.

Short-term Effectiveness

While the No Action Alternative (LNAPL/SW-1) will not be effective in the short-term in protecting human health or the environment, because no remedial activities will occur, there will be no adverse impacts to the public or workers performing the cleanup, or the environment. Alternatives LNAPL/SW-2 and -3 are expected to pose minimal risk to the community from O&M and transport of collected LNAPL. These alternatives also pose very low risk to workers and collected LNAPL and treatment residuals can be minimized by use of BMPs. Installation of new wells and infrastructure is expected to have short-term impacts to the environment. An estimated one year is the timeframe for remediating LNAPL under Alternatives LNAPL/SW-2 through -4. Groundwater extraction and treatment for these three alternatives will require resources and material handling for an extended length of time. A 30-year timeframe was used for O&M, monitoring, and cost estimation purposes for the surface water component.

Alternative LNAPL/SW-4 poses potential risks to the community from releases of vapor as well as structural stability issues in excavating close to the Massachusetts Bay Transportation Authority (MBTA) railroad tracks. Construction of the PRBs would have significant short-term impacts to the environment as trenching (heavy construction) will occur in sensitive areas. Soil excavation also poses the highest risks to workers from direct contact and inhalation of fugitive soil dusts. These issues can be mitigated, however, by the use of BMPs. Overall, Alternative LNAPL/SW-4 has the greatest possible short-term impacts, though is estimated to be constructed in less than one year.

Implementability

The No Action Alternative (LNAPL/SW-1) is the easiest to implement because no remedial activities are required. The remaining alternatives all use standard construction equipment and there are no infrastructure issues. Groundwater extraction and treatment is a reliable and readily available technology and allows for optimization, increasing the reliability. The PRBs would require a PDI and bench-scale testing. Once constructed, there is little post-construction flexibility and therefore less reliability compared to groundwater extraction. For the PRBs, large quantities of reactive material are needed, requiring extra lead time to ensure adequate supply during implementation. Overall, of the three action alternatives, Alternative LNAPL/SW-3 is the most reliable and easiest to implement.

Costs

The costs for all alternatives are presented in Table 1, *Comparative Analyses of Remedial Alternatives*, below. The overall costs for Alternatives LNAPL/SW-2, -3, and -4 are $9 million, $6.6 million, and $9 million, respectively. Except for the costs of the five-year reviews, there is no cost associated with the No Action Alternative (LNAPL/SW-1).

Final Action – Soil and Sediments

Overall Protection of Human Health and the Environment

The No Action Alternative (SOIL/SED-1) offers no protection of human health and the environment. All other alternatives are expected to protect human health and the environment by eliminating risks to the public from direct exposure to and inhalation of Site contaminants, and eliminating risks to ecological receptors from direct exposure and ingestion. Site Management Plans (SMPs) and Institutional Controls would be incorporated into each of these alternatives to address soil remaining with concentrations above those allowed for unrestricted use/unrestricted exposure, prevent disturbance of remedial measures, and restrict use to commercial/industrial. All alternatives would require five-year reviews, since each would leave contaminated soil in place that exceeds unrestricted use risk standards.

Compliance with ARARs

All alternatives, except for the No Action Alternative (SOIL/SED-1), have been developed to comply with ARARs. With proper implementation, it is anticipated that Alternatives SOIL/SED-2, -3 and -4 would meet action-specific, location-specific, and chemical-specific ARARs (see Tables 2.1-1 – 2.1-9 in the FS report Volume I and Tables 2.1-11 – 2.1-13 in the FS report Volume II).

Any wastes generated by remedial activities for Alternatives SOIL/SED-2 through -4 would be managed on-site in compliance with ARARs until disposed of at a permitted, off-site disposal facility. Any water generated during soil and sediment excavation and de-watering activities would be characterized and treated appropriately, then either discharged to surface water or disposed of off-site, as appropriate. Excavated areas would then be backfilled with clean soils, which would serve as a cap over areas of remaining subsurface contamination. All work within wetlands and streams would meet location-specific ARARs for protecting water quality and impacted wetlands would be re-established following completion of remedial activities.

The Containment Area cap under Alternatives SOIL/SED-2 and -3 would comply with RCRA Subtitle D regulations and Massachusetts solid waste management regulations and meet impermeability requirements with an effective permeability of the existing slurry wall (approximately 1×10^{-8} centimeters/second (cm/s)) or a permeability of no greater than 1×10^{-7} cm/sec, whichever is less. Excavated contaminated wetland soil and sediments determined to contain hazardous waste would be managed in accordance with RCRA hazardous waste regulations.

Long-term Effectiveness and Permanence

The No Action Alternative (SOIL/SED-1) is the least effective alternative for long-term effectiveness and permanence because risks from Site contaminants in soil and sediments are not addressed. Each of the other alternatives has some degree of residual risk due to contamination that will remain on-site and will require five-year reviews to assess the ongoing protectiveness of the remedy and Institutional Controls to prevent exposure to the remaining contamination. Alternative SOIL/SED-4 would be the most effective in the long-term, as this alternative provides for removal of the greatest quantities of contaminated soil and contamination that is furthest from the surface than either Alternatives SOIL/SED-2 or -3.

Alternatives SOIL/SED-2 and -3 include a permanent, impermeable cap over the Containment Area and closure of the equalization window. These actions would help to hydraulically isolate the impacted soils, reduce the potential for contaminants to leach and migrate, and therefore control the exposure to contaminants remaining in place. Installation of the cap will help to minimize leaching from impacted soil remaining in place. Under Alternative SOIL/SED-2, contaminated upland soil would be covered to eliminate the exposure pathway for ecological receptors, and engineering controls for TMPs would be required for new construction to address potential vapor intrusion risks. The long-term effectiveness of the soil cover and Institutional Controls to prevent disturbance and require engineering controls to address vapor intrusion would be contingent on maintenance and monitoring of the controls chosen during remedy design.

Under Alternative SOIL/SED-4, excavation and replacement with clean soil would reliably reduce the potential for human health and ecological risk. Some residual risk would remain for the soil that remains (e.g., contaminated soil remaining in the Containment Area that is more than 10 feet deep), but Institutional Controls would prevent exposure to this soil and prevent use other than commercial/industrial.

Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

No treatment is provided for in the No Action Alternative (SOIL/SED-1), and thus no reduction in TMV through treatment is provided. Alternatives SOIL/SED-2 and -4 provide comparable reductions in contaminant TMV through treatment, while Alternative SOIL/SED-3 provides the highest reduction. All alternatives, with the exception of the No Action Alternative, reduce the mobility of contaminants throughout the Site by providing for their on-site containment, off-site disposal, and/or treatment. However, active treatment is a component of only one alternative–SOIL/SED-3–via air sparging/SVE.

Short-term Effectiveness

While the No Action Alternative (SOIL/SED-1) will not be effective in the short-term in protecting human health or the environment, because no remedial activities will occur, there will be no adverse impacts to the public or workers performing the cleanup, or short-term impacts to natural habitats. The remaining alternatives –Alternatives SOIL/SED-2 through -4–will all meet the established RAOs for soil and sediments in the same general timeframe, and all will require generally the same amount of time to construct (approximately two years). These alternatives all include excavation and consolidation of contaminated soil and sediments, to varying degrees, which will have some short-term impacts or risks. Alternative SOIL/SED-2 will require approximately

6,000 tons of contaminated soil and sediments to be transported off-site; Alternative SOIL/SED-3 will require approximately 10,000 tons; and Alternative SOIL/SED-4 will require approximately 130,000 tons.

Of these three alternatives, Alternative SOIL/SED-2 would be the most effective in the short-term. The least amount of soil and sediments is handled by this alternative, which means it creates the least exposure risk to the community, workers, and the environment (via fugitive dust or the active work environment), while the most amount of material is handled by Alternative SOIL/SED-4, which would create the most risk from these perspectives. Excavation of deeper upland soil under Alternative SOIL/SED-4 may also require excavation support to protect the railroad, which would entail greater risks to workers. Risks to the community include from increased transportation of hazardous materials and increased traffic to bring in backfill material, and some of the excavated soil may have contaminated soil vapor, however, BMPs would reduce these risks to the community.

Implementability

The No Action Alternative (SOIL/SED-1) would not require any actions to be taken at the Site and therefore does not present any implementability issues. All remaining alternatives are relatively comparable given that they involve routine construction work (conventional and available technology), available trained personnel and materials, and, in the case of air sparging/SVE for TMPs under Alternative SOIL/SED-3, a technology that was previously implemented at the Site without any issues related to construction or operation. Alternatives SOIL/SED-3 and -4 are comparatively more difficult to implement than Alternative SOIL/SED-2 because the former require managing and consolidating the greatest amount of waste and, in the case of Alternative SOIL/SED-4, a possible need for sheet piling for soil structural support in an area near the MBTA railroad tracks where the structural stability of soil may be a concern. Overall, of the three action alternatives, Alternative SOIL/SED-2 is the most reliable and easiest to implement.

Costs

The costs for all alternatives are presented in **Table 1**, *Comparative Analyses of Remedial Alternatives,* below. Except for the costs of the five-year reviews, there is no cost associated with the No Action Alternative (SOIL/SED-1). The overall costs for Alternatives SOIL/SED-2, -3, and -4 are $6 million, $7.5 million, and $34.2 million, respectively.

WHY EPA RECOMMENDS THIS PROPOSED CLEANUP PLAN

Based on the results of the RI activities and risk evaluations, a range of cleanup alternatives for the Olin Site were developed in the FS report to provide for an interim action for DAPL and groundwater hot spots and a final action for LNAPL, surface water, soil, and sediments. After evaluating the alternatives in this report, EPA recommends the following cleanup plan as the best balance among EPA's required evaluation criteria that meets the cleanup objectives for the Site:

Alternative DAPL/GWHS-3, DAPL extraction (approx. 20 wells), groundwater hot spot extraction targeting 5,000 ng/L NDMA (approx. 6 wells), and on-site treatment at a new treatment system is EPA's preferred alternative for an interim action to address the major sources of contamination to groundwater – DAPL and groundwater hot spots (See **Figure 5**, *Conceptual plan for Alternative DAPL/GWHS-3* and **Figure 6**, *Cross-section of the conceptual plan for Alternative DAPL/GWHS-3*, below). EPA prefers this alternative for the following reasons:

- Uncontrolled DAPL sources–a major source of contamination to downgradient water and highly toxic –will be removed and treated;

- Groundwater hot spots will be removed and treated, thereby limiting the further spread of highly contaminated groundwater which acts as a source of contamination to the aquifer;
- This alternative provides the best balance between the amount of contaminant mass removed (approx. 7,013 grams [g] NDMA from the overburden aquifer) for the volume of groundwater that must be extracted to achieve this reduction (approx. 68.4 million gallons). By contrast, Alternative DAPL/GWHS-2 would remove approximately 40% less NDMA mass (approx. 4,159 g), and Alternative DAPL/GWHS-4 would require the extraction of 40 million additional gallons of groundwater to achieve only a modest increase in the mass of NDMA removed (4% or approx. 300 g of NDMA);
- Institutional Controls will prevent human exposure to contaminated groundwater by prohibiting unauthorized use as a drinking water source until cleanup goals are met; and
- Of the three action alternatives considered, this option has moderate costs ($35.5 million, as compared to $22.5 million for Alternative DAPL/GW-2 and $40.5 million for Alternative DAPL/GW-4).

Alternative LNAPL/SW-3, Demolition of Plant B, MPE for LNAPL, targeted groundwater extraction to prevent discharge to surface water, and on-site treatment at a new treatment system is EPA's preferred alternative for a final action to address LNAPL and contamination in surface water (see **Figure 7**, *Conceptual plan for Alternative LNAPL/SW-3*, below). EPA prefers this alternative for the following reasons:

- Achieves substantial risk reduction by treating LNAPL *in-situ* (in place) via MPE, which uses standard, readily-available equipment, with the demolition of Plant B facilitating access to the entire footprint of the LNAPL-contaminated zone for treatment;
- Uses a proven, effective technology that allows for optimization (groundwater extraction and treatment) to permanently remove Site contaminants from groundwater and prevent contaminated groundwater from impacting the streams;
- Of the three action alternatives considered, this alternative provides for the greatest reduction of contaminant treatment, mobility, and volume through treatment, and is the most reliable and easiest to implement; and
- Of the three action alternatives considered, this option has the lowest costs ($6.6 million, as compared to $9 million each for Alternatives LNAPL/SW-2 and LNAPL/SW-4).

Alternative SOIL/SED-2, Containment Area cap, upland soil covers, excavation with off-site disposal and restoration of wetland soil and sediments, limited action for TMPs (Institutional Controls, including vapor intrusion evaluation or vapor barriers/sub-slab depressurization systems) is EPA's preferred alternative for a final action to address contaminated soil and sediments (see **Figure 8**, *Conceptual plan for Alternative SOIL/SED-2*, below). EPA prefers this alternative for the following reasons:

- Eliminates risks to human health–from direct exposure to Site contaminants–and risks to ecological receptors by removing and disposing and/or covering contaminated soil and sediments;
- Permanently removes contaminants in wetland soil and sediments–thus eliminating future exposures for ecological receptors–by excavating and disposing off-site all wetland soil and sediments with levels of Site contaminants above cleanup goals and restoring any disturbed wetland/aquatic habitat;
- Of the three action alternatives considered, is the most reliable and easiest to implement, and creates the least risk to the community, workers, and the environment because the least amount of contaminated soil and sediments are handled (6,000 tons of material, as compared to 10,000 tons for Alternative SOIL/SED-3 and 130,000 tons for Alternative SOIL/SED-4);
- Minimizes leaching from the Containment Area feature via an impermeable cover coupled with closure of the equalization window notched into the slurry wall;

- Achieves protectiveness of public health from inhalation risks associated with TMPs at a lower cost than that of the action alternatives considered for TMPs–vapor intrusion risks in future buildings will be addressed by Institutional Controls and engineering controls (requirements to conduct evaluations or install engineered systems to prevent unacceptable levels of contaminated vapors from accumulating indoors);
- Institutional Controls will address soil remaining with concentrations above those allowed for unrestricted use/unrestricted exposure, prevent disturbance of remedial measures, and restrict use of the Olin property to commercial/industrial; and
- Of the three action alternatives considered, this option has the lowest costs ($6 million, as compared to $7.5 million for Alternative SOIL/SED-3 and $34.2 million for Alternative SOIL/SED-4).

The preferred cleanup approach includes long-term monitoring of groundwater and surface water to evaluate the effectiveness of the cleanup measures and periodic five-year reviews to assess remedy protectiveness. Environmental investigations will continue to close remaining data gaps – these data gaps include the need for an improved characterization of bedrock topography and further delineation of the horizontal and vertical extent of groundwater contamination and the DAPL pools. The results of these efforts will be used to evaluate long-term groundwater cleanup options, leading to the selection of a final groundwater cleanup plan for the Olin Site.

The preferred cleanup approaches will also minimize impacts to wetland areas to the extent possible, and provide restoration of unavoidable damage to accelerate habitat recovery. Actions will be taken to ensure that current flood storage capacities will not be diminished after completion of the proposed remedial activities.

EPA believes this proposed cleanup plan for the Olin Chemical Superfund Site achieves the best overall balance among EPA's nine criteria (excluding State and community acceptance which will be considered following public comment) used to evaluate the various alternatives presented in the Feasibility Study. This cleanup approach provides both short- and long-term protection of human health and the environment; attains applicable federal environmental and state environmental and facility siting laws and regulations; reduces the toxicity, mobility, and volume of contaminants through treatment to the extent practicable; utilizes permanent solutions; and uses land use restrictions to prevent unacceptable exposures in the future to the remaining Site-related contamination (see **Figure 9**, OU3 Groundwater Study Area and Extent of Groundwater Institutional Controls). While the approach may result in adverse impacts to floodplains and wetland areas, these impacts will be minimized to the extent practicable and restoration of unavoidable damages is included in the proposed cleanup.

EPA believes that this proposed cleanup approach is protective of human health and the environment through the use of proven cleanup technologies such as groundwater extraction and treatment, *in-situ* soil treatment, soil excavation and/or covers, off-site disposal, use or access restrictions, and is cost-effective, while achieving the site-specific cleanup objectives within a reasonable timeframe.

WHAT IS A FORMAL COMMENT?

EPA will accept public comments during the 30-day public comment period, which runs from **Wednesday, August 26, 2020 to Friday, September 25, 2020**. EPA considers and uses these comments to improve its cleanup approach. During the formal comment period, EPA will accept written comments via e-mail or mail. Comments can be e-mailed no later than **Friday, September 25, 2020** to the EPA Project Manager, Melanie Morash, at morash.melanie@epa.gov. EPA has established a dedicated voice mailbox at (617) 918-1880 to receive oral comments during the comment period. Comments can also be provided to EPA during the virtual Public Hearing on **Tuesday, September 22, 2020, beginning at 7 p.m.**, during which a stenographer will record all offered comments during the hearing. EPA will not respond to your comments during the formal Public Hearing, but will provide written responses to comments as part of its final decision document.

Written comments must be postmarked no later than **Friday, September 25, 2020** and should be sent to:

Melanie Morash
U.S. EPA Region 1 – New England, Mail Code 7-4
5 Post Office Square
Boston, MA 02109-3912

Prior to the formal Public Hearing, EPA will hold a virtual Informational Meeting on **Tuesday, August 25, 2020, beginning at 7 p.m.** The purpose of the Informational Meeting is to provide an opportunity for residents and other interested persons to learn more about the Proposed Plan to clean up the Site and ask questions. During the meeting, EPA will give a presentation on the background of the Site, the nature and extent of contamination, and exposure risks, and describe the proposed approach to Site clean-up.

EPA will consider all written and oral comments submitted by residents, members of the public, and interested stakeholders during the comment period and then make a formal decision selecting a cleanup plan. That cleanup plan will be set forth in an official document known as the Record of Decision (ROD). The ROD will include a *Response to Comments* section to address all comments received during the public comment period in writing. EPA expects to issue the ROD in late 2020 or early 2021. The *Responsiveness Summary* and ROD will be made available to the public online at: www.epa.gov/superfund/olin

EPA will announce the final decision on the cleanup plan through local media and on EPA's website.

FOR MORE DETAILED INFORMATION

The Administrative Record, which includes all documents that EPA has considered or relied upon in proposing this cleanup plan for the Olin Chemical Superfund Site in Wilmington, Massachusetts, is available for public review online at: www.epa.gov/superfund/olin

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ACRONYMS

AEL	Administrator's Emphasis List
AOC	Administrative Settlement Agreement and Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
AS/SVE	air sparging/soil vapor extraction
BEHP	bis-2-ethylhexylphthalate
bgs	below ground surface
BMPs	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
cm/s	centimeters per second
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CSA	Comprehensive Site Assessment
CSF	Cancer Slope Factor
CSL	Calcium Sulfate Landfill
CTE	Central Tendency Exposure
CWA	Clean Water Act
cy	cubic yard
DAPL	Dense Aqueous Phase Liquid
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
FRI	Focused Remedial Investigation
FS	Feasibility Study
ft	foot
g	grams
GAC	Granular Activated Carbon
gpm	gallons per minute
GWHS	Groundwater Hot Spots
HI	Hazard Index
HQ	Hazard Quotient
IC	Institutional Control
IRSWP	Interim Response Steps Work Plan
IUR	Inhalation Unit Risk
LNAPL	Light Non-Aqueous Phase Liquid
MassDEP	Massachusetts Department of Environmental Protection
MADEQE	Massachusetts Department of Environmental Quality Engineering
MBTA	Massachusetts Bay Transportation Authority
MCP	Massachusetts Contingency Plan
mg/kg	milligrams per kilogram
MMB	Maple Meadow Brook
msl	mean sea level
MPE	multi-phase extraction
MWRA	Massachusetts Water Resources Authority
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDMA	n-nitrosodimethylamine
NDPA	n-nitrosodiphenylamine
ng/L	nanograms per Liter

NPL	National Priorities List
O&M	Operations and Maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbons
PDI	pre-design investigation
PPE	Personal Protective Equipment
PRB	Permeable Reactive Barrier
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RfC	Reference Concentration
RfD	Reference Dose
RGP	Remediation General Permit
RI	Remedial Investigation
ROD	Record of Decision
SED	Sediments
SI	Site Inspection
SMP	Site Management Plan
SVOC	Semi-Volatile Organic Compound
SW	Surface Water
TBC	To-Be-Considered
TMPs	Trimethylpentenes
TMV	toxicity, mobility, or volume
TSDF	treatment, storage, and disposal facility
UCL	Upper Concentration Limit
µg/L	micrograms per Liter
UV	ultra-violet
VI	Vapor intrusion
VOC	Volatile Organic Compound

Table 1 - Comparative Analyses of Remedial Alternatives

ALTERNATIVES BY MEDIUM	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Capital Cost	O&M Cost	Total (Net Present Value) (1)
Alternative DAPL/GWHS-1: No action alternative	✕	✕	N/A	N/A	-	+ +	$0	$0	$0
Alternative DAPL/GWHS-2: DAPL extraction (approx. 5 wells), groundwater hot spot extraction targeting 11,000 ng/L (approx. 2-3 wells), on-site treatment at new treatment system alternative	✓	✓	-	+	+	+	$10,253,755	$21,701,568	$22,518,229
Alternative DAPL/GWHS-3: DAPL extraction (approx. 20 wells), groundwater hot spot extraction targeting 5,000 ng/L (approx. 6 wells), on-site treatment at new treatment system alternative	✓	✓	+	+ +	+	+	$15,625,318	$24,620,268	$35,497,565
Alternative DAPL/GWHS-4: DAPL extraction (approx. 20 wells), groundwater hot spot extraction targeting 1,100 ng/L (approx. 12 wells), on-site treatment at new treatment system alternative	✓	✓	+ +	+ +	-	-	$19,289,931	$26,519,632	$40,464,350
Alternative LNAPL-SW-1: No action alternative	✕	✕	N/A	N/A	-	+ +	$0	$0	$0
Alternative LNAPL/SW-2: MPE for LNAPL with treatment at Plant B, groundwater extraction to prevent discharge to surface water, on-site treatment at new treatment system alternative	✓	✓	-	+	-	+	$4,638,520	$6,534,000	$9,005,134
Alternative LNAPL/SW-3: Demolition of Plant B, MPE for LNAPL, targeted groundwater extraction to prevent discharge to surface water, on-site treatment at new treatment system alternative	✓	✓	+	+ +	+	+ +	$2,278,032	$7,356,000	$6,644,452
Alternative LNAPL/SW-4: Excavation of LNAPL with off-site disposal, PRBs to treat groundwater before discharge into surface water	✓	✓	+ +	+	- -	-	$5,313,855	$6,726,091	$8,976,238
Alternative SOIL/SED-1: No action alternative	✕	✕	N/A	N/A	-	+ +	$0	$0	$0
Alternative SOIL/SED-2: Containment Area cap, upland soil covers, excavation with off-site disposal and restoration of wetland soil and sediments, limited action for TMPs (Institutional Controls, including vapor intrusion evaluations or vapor barriers/sub-slab depressurization systems) alternative	✓	✓	+	-	+	+ +	$5,614,205	$1,127,600	$6,072,515
Alternative SOIL/SED-3: Containment Area cap, excavation (0-1 ft) with off-site disposal and clean soil cover for upland soil, excavation with off-site disposal and restoration of wetland soil and sediments, air sparging and SVE for TMPs alternative	✓	✓	+	+	-	+	$6,686,227	$1,522,200	$7,470,417
Alternative SOIL/SED-4: Excavation (0-10 ft) with off-site disposal and clean soil cover for Containment Area and upland soil, excavation with off-site disposal and restoration of wetland soil and sediments, excavation and off-site disposal for TMPs alternative	✓	✓	+ +	-	- -	+	$34,045,584	$330,400	$34,174,675

Notes:

✕ Fails - - Poor
✓ Passes - Fair
\+ Good
\+ + Very Good

(1) "Present Value" is the amount of money set aside today to ensure that enough money is available over the expected life of the project, assuming certain conditions (e.g., inflation). Cost information was presumed over a 30-year period, using a 7% discount rate.

DAPL = Dense Aqueous Phase Liquid
ft = feet
LNAPL = Light Non-Aqueous Phase Liquid
MPE = multi-phase extraction
ng/L = nanograms per Liter
PRB = Permeable Reactive Barrier
SVE = soil vapor extraction
TMPs = trimethylpentenes

Table 2 – Proposed Cleanup Levels and Performance Standards to Address Human Health Risks

Key Risk Drivers*	Proposed Cleanup Level	Receptor (Exposure Pathway)	Notes	Human Health Reasonable Maximum Exposure Scenario Receptor Risk & Hazard Index
Dense Aqueous Phase Liquid (DAPL)				
NDMA	N/A (1)	Resident (Ingestion, Dermal Contact, Inhalation by Showering)	No MCL	CR = 3×10^{-2} HI = 3,379 (3)
Groundwater Hot Spots				
NDMA	N/A (2)	Resident (Ingestion, Dermal Contact, Inhalation by Showering)	No MCL	CR = 3×10^{-2} HI = 291 (3)
Upland Soil**				
Metals, benzo(a)pyrene	N/A (2)	Future On-Property Resident (Ingestion, Dermal Contact, Inhalation of Airborne Dusts)	Data obtained from surface soil	CR = 4.1×10^{-3} HI = 31
			Data obtained from subsurface soil	CR = 7.0×10^{-4} HI = 203
TMPs	Total TMPs in Indoor Air = 0.175 mg/m^3	Future Indoor Worker or Building Occupant (Inhalation of Indoor Air – Vapor Intrusion from Subsurface Soil)	Vapor intrusion risks not quantified in HHRA (4)	
Surface Water Performance Standards				
Benzo(a)pyrene	**Proposed Performance Standard** 0.9 µg/L (5)	Trespasser in Off-Property West Ditch Stream (Ingestion, Dermal Contact)	Surface water samples collected from the off-Property portion of West Ditch Stream	CR = 5×10^{-4} HI = 0.2

Acronyms

BEHP bis-2-ethylhexylphthalates
BMPs Best Management Practices
CA Containment Area
CR Excess Lifetime Cancer Risk
HHRA Human Health Risk Assessment
HI Hazard Index
ICs Institutional Controls
MCL Maximum Contaminant Limit
mg/m^3 milligrams per cubic meter
N/A Not Applicable
NDMA n-nitrosodimethylamine

UCL Upper Confidence Limit
µg/L micrograms per Liter

Notes

(1) Interim remedy focused on mass removal.
(2) ICs to prevent residential use.
(3) See Draft OU3 RI Report, July 2019, Appendix K, *Revised Draft Baseline Human Health Risk Assessment Operable Unit 3,* Table 5.2-1.
(4) Vapor intrusion risks only qualitatively evaluated in the HHRA for upland soil because currently there are no occupied buildings on-site.
(5) Proposed performance standard set at a target CR of 1×10^{-4}.

*For the full list of contaminants that contribute risk, see Draft OU3 RI Report, June 2019, Appendix K, *Revised Draft Baseline Human Health Risk Assessment Operable Unit 3.*

**The term *upland soil* includes Containment Area soil

Table 3 – Proposed Cleanup Levels and Performance Standards to Address Ecological Risks

Key Risk Drivers*	Proposed Cleanup Level	Receptor	Basis	Maximum Detection or Reasonable Maximum Exposure Scenario
Upland Soil				
Chromium	1,000 mg/kg	American Robin Short-Tailed Shrew	Geometric mean of NOAEL-PRG & LOAEL-PRG	26,344 mg/kg
BEHP	3 mg/kg			103 mg/kg
Wetland Soil				
Chromium	600 mg/kg	Marsh Wren	Geometric mean of NOAEL-PRG & LOAEL-PRG	2,400 mg/kg
BEHP	20 mg/kg			602 mg/kg
Streambank Soil/Sediments				
Chromium	100 mg/kg	Insect-Eating Birds	Probable Effects Concentration & conclusion from REACH dossier	2,400 mg/kg
BEHP	100 mg/kg		Conclusion from REACH dossier	602 mg/kg
Surface Water Performance Standards (1)				
Chromium	**Proposed Performance Standard** 0.1 mg/L	Aquatic Organisms & Benthic Invertebrates	Arithmetic mean of hardness-adjusted CCC at seven water bodies at the Site	Acute Toxicity (42-Day Hyalella Azteca Sediment Toxicity Test)
Ammonia	**Proposed Performance Standard** 15 mg/L		CCC for Site-specific pH and temperature during Spring months at East Ditch Stream, applied to all surface water at the Site	

Acronyms

BEHP	bis-2-ethylhexylphthalates
CCC	Criterion Continuous Concentration from EPA NRWQC
LOAEL-PRG	Lowest-observed-adverse-effect-level-Preliminary Remediation Goal
mg/kg	milligrams per kilogram
mg/L	milligrams per Liter

NOAEL	No-observed-adverse-effect-level
NRWQC	National Recommended Water Quality Criteria
PEC	Probable Effects Concentration
REACH	European Regulation on Registration, Evaluation, Authorization, and Restriction of Chemicals https://echa.europa.eu/home
TRV	Toxicity Reference Value

Notes

(1)	These proposed performance standards will be used to monitor surface water to determine the effectiveness of the surface water remedy in addressing groundwater migration.

*For the full list of contaminants that contribute risk, see OU1/OU2 FS Report, July 2015, Appendix N, *Baseline Ecological Risk Assessment.*

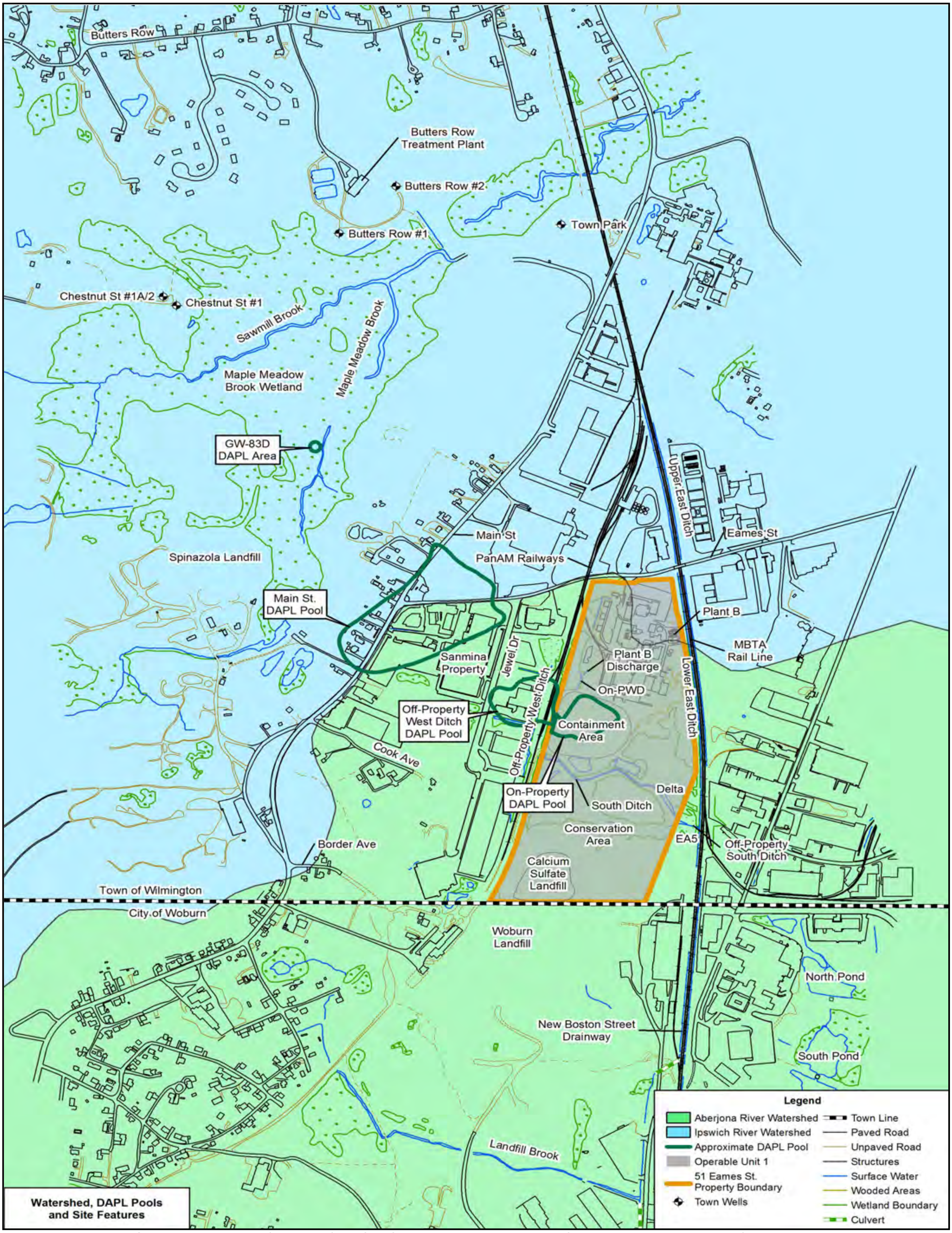

Figure 1. Area map. Shown are the major features of the Olin Site, watersheds, nearby surface waters, and the pools of Dense Aqueous-Phase Liquid (DAPL). Site straddles two watersheds – the Ipswich River Watershed to the north (in blue) and the Aberjona River Watershed to the south (in green). Visible are the subsurface pools of DAPL (shown in green outline), located in depressions on the top of bedrock.

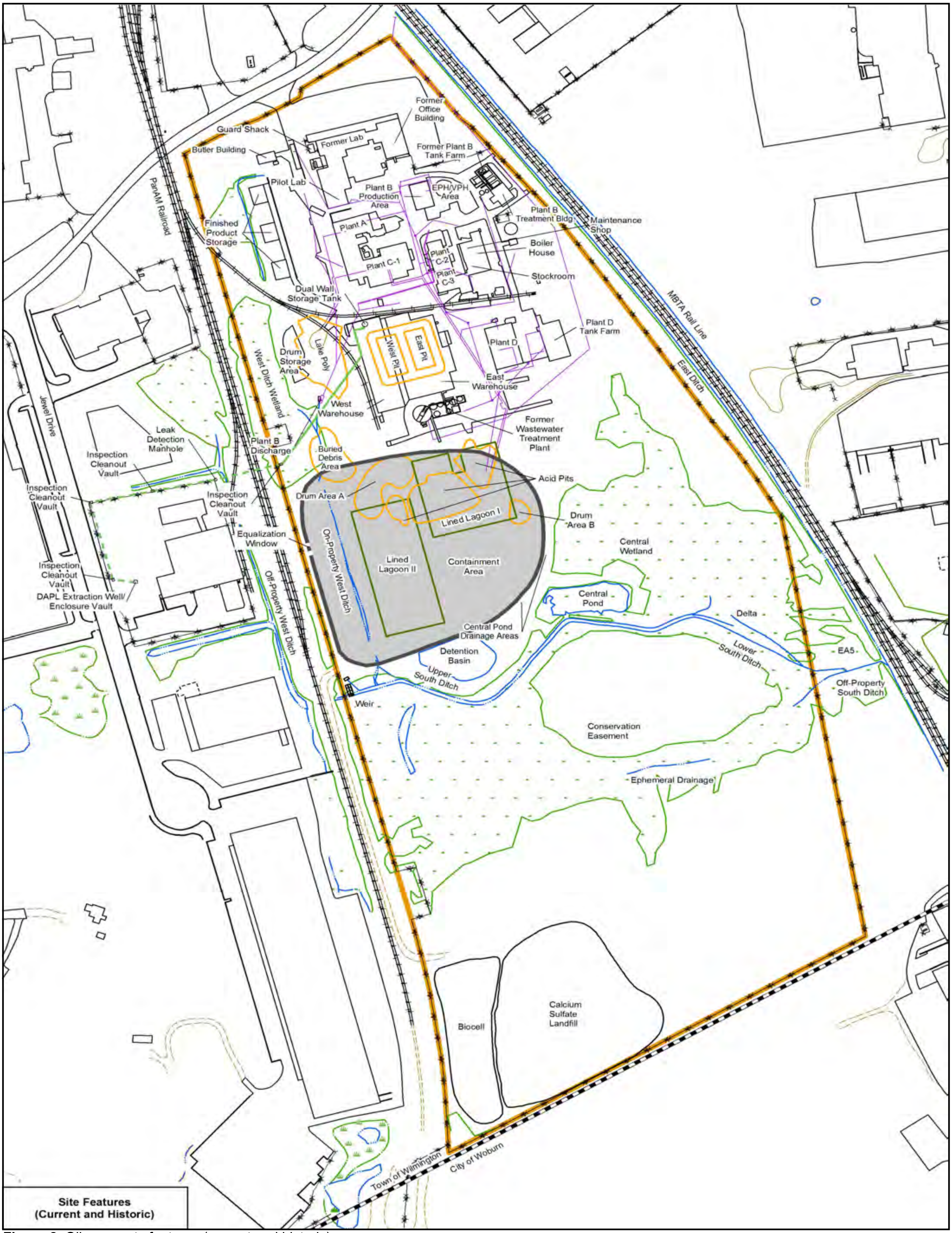

Figure 2. Olin property features (current and historic).

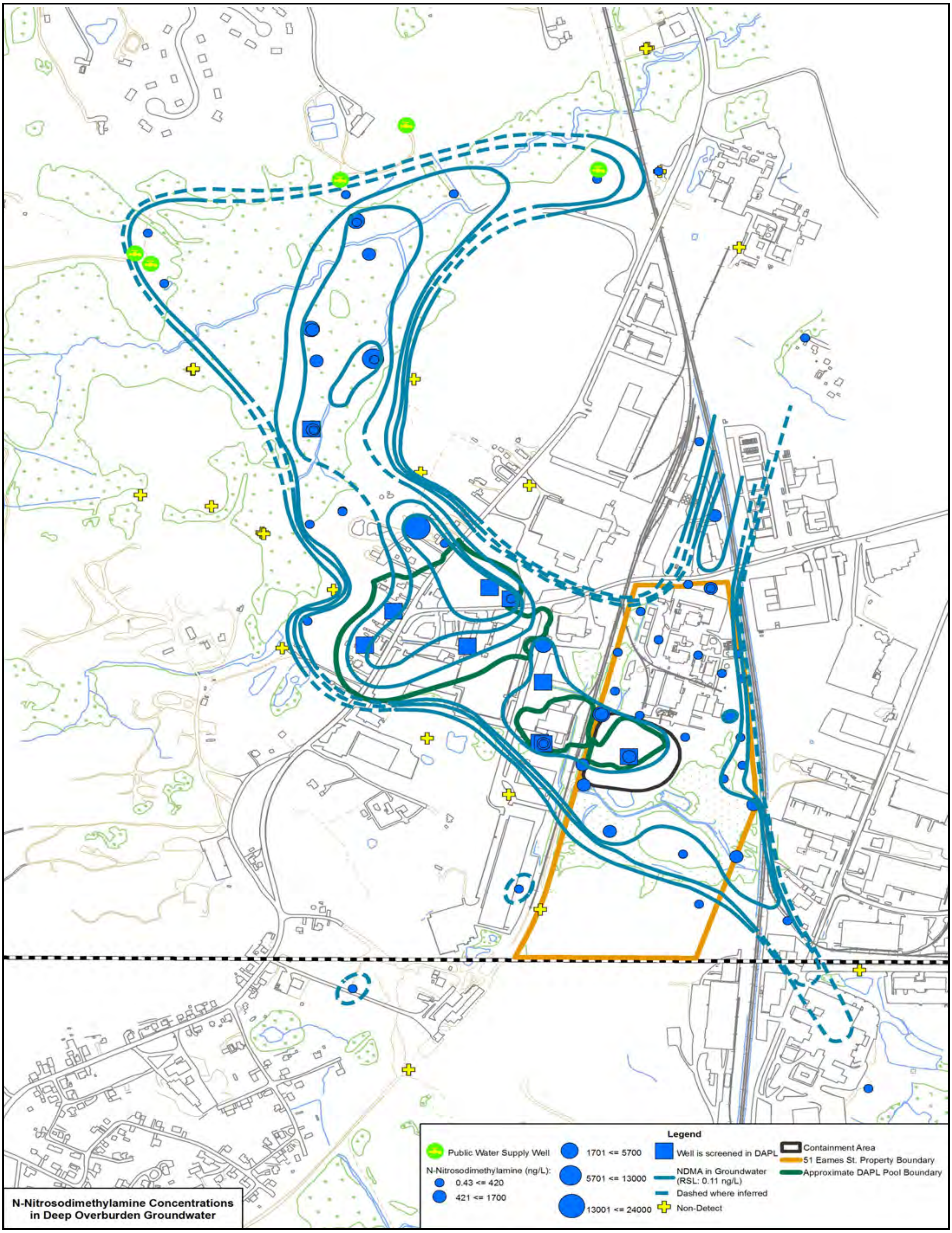

Figure 3. Olin Site contaminant plume in shallow overburden groundwater. Contour map based on historical concentrations of n-nitrosodimethylamine (NDMA) – the primary Site contaminant that drives human health risks.

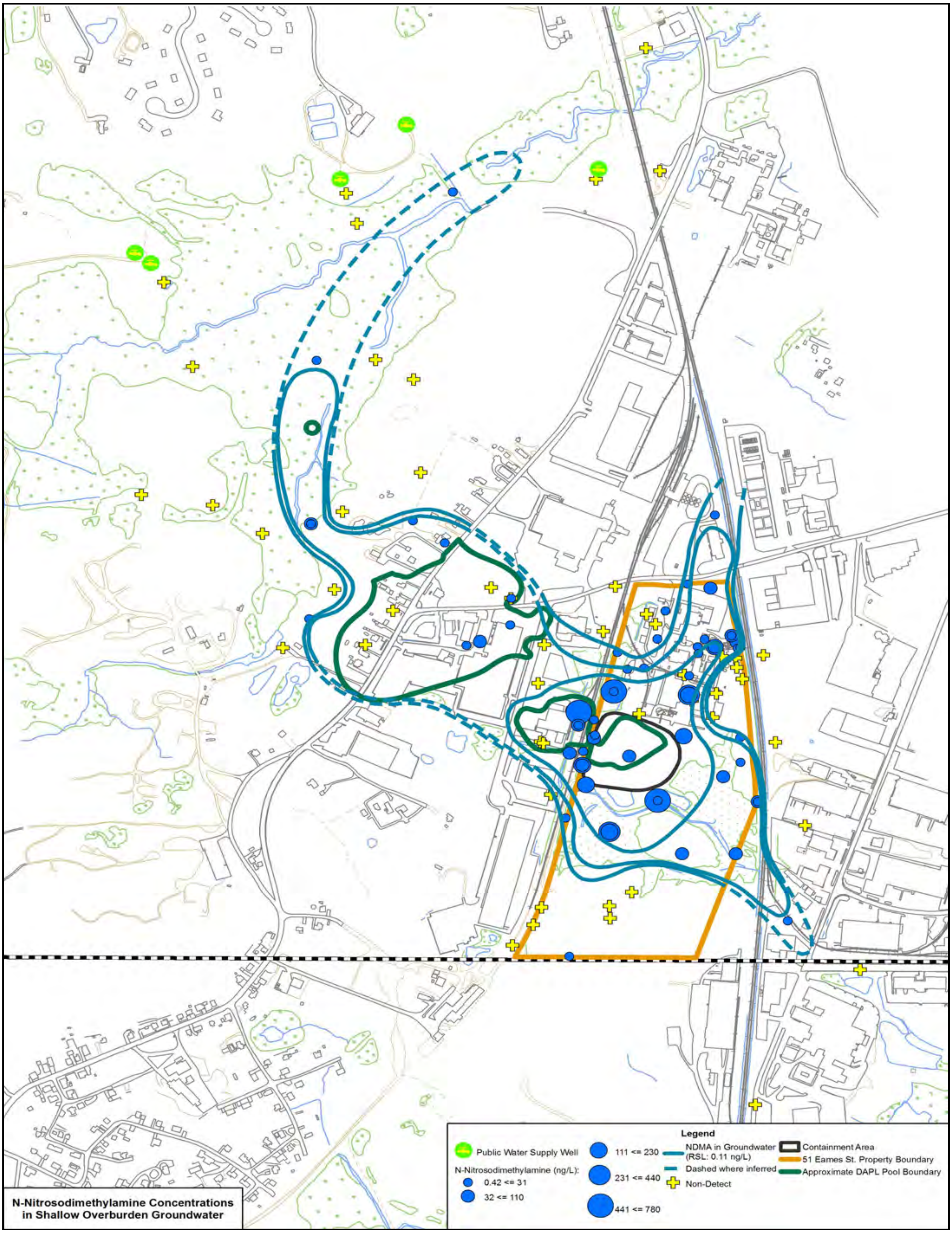

Figure 4. Olin Site contaminant plume in deep overburden groundwater. Contour map based on historical concentrations of n-nitrosodimethylamine (NDMA) – the primary Site contaminant that drives human health risks.

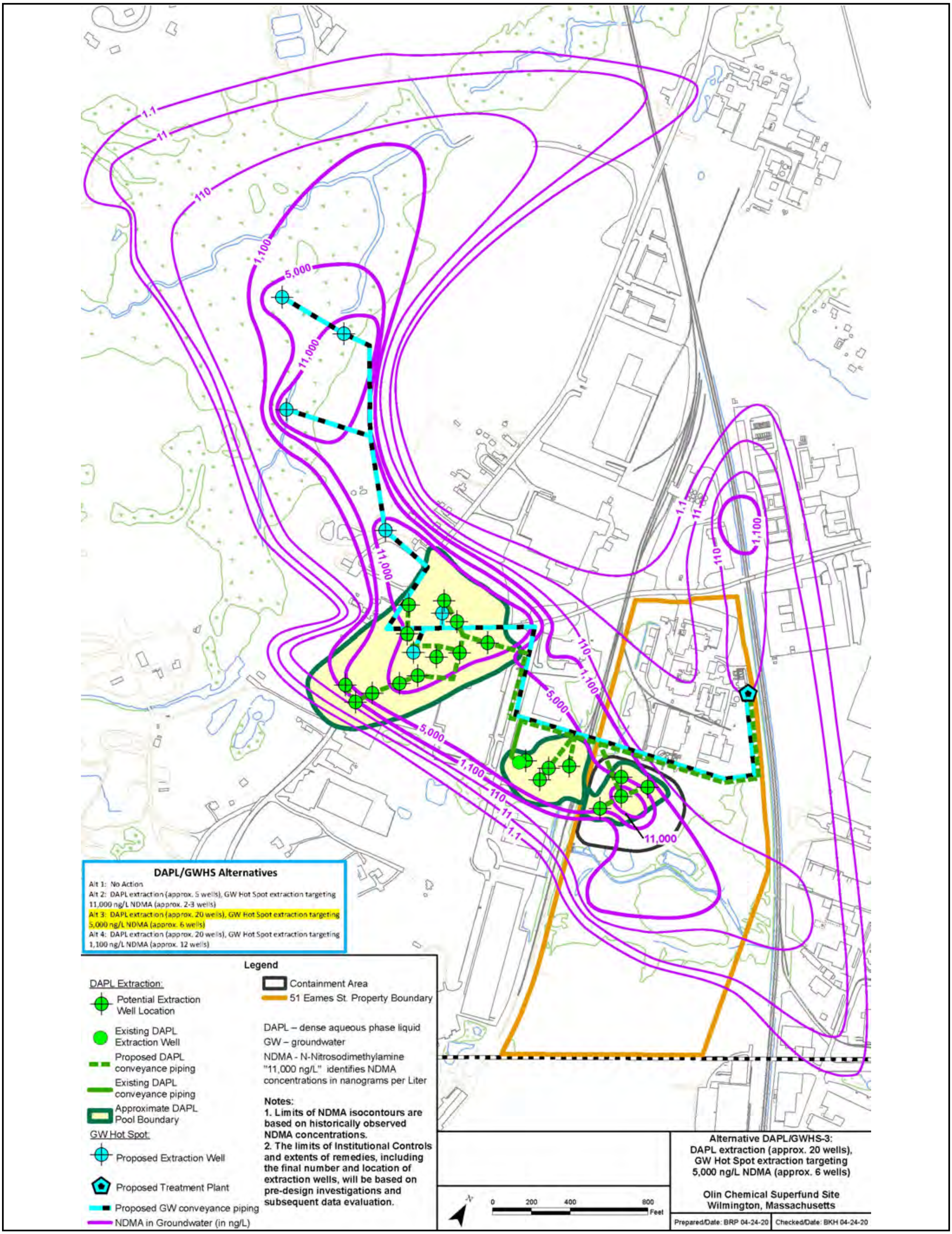

Figure 5. Conceptual plan for Alternative DAPL/GWHS-3. Dense Aqueous-Phase Liquid (DAPL) extraction (approximately 20 wells), groundwater hot spot extraction targeting 5,000 nanograms per Liter (ng/L) n-nitrosodimethylamine (NDMA; approximately 6 wells), and on-site treatment at a new treatment system.

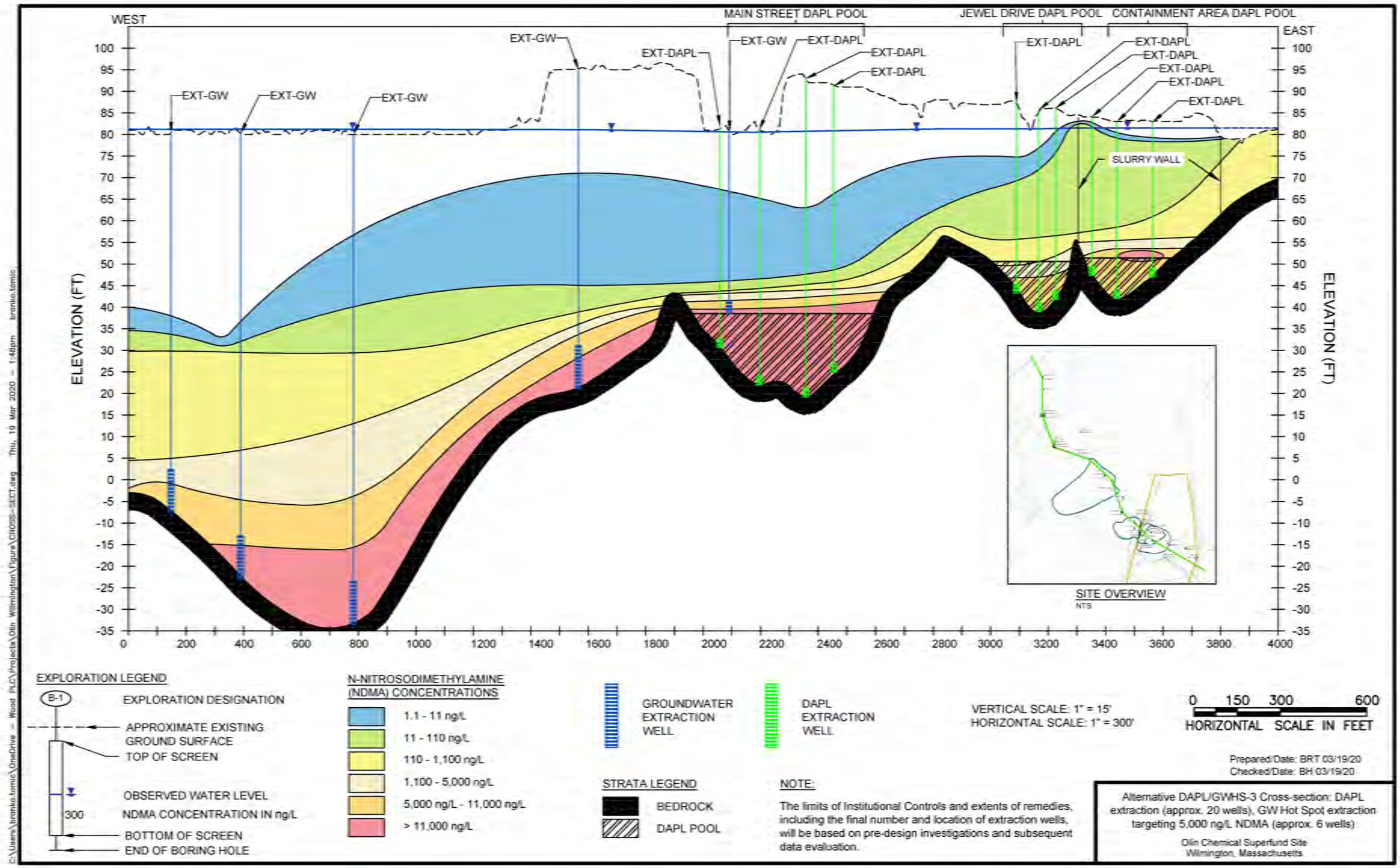

Figure 6. Cross-section of the conceptual plan for Alternative DAPL/GWHS-3. Dense Aqueous-Phase Liquid (DAPL) extraction (approximately 20 wells), groundwater hot spot extraction targeting 5,000 nanograms per Liter (ng/L) NDMA (n-nitrosodimethylamine; approximately 6 wells), and on-site treatment at a new treatment system.

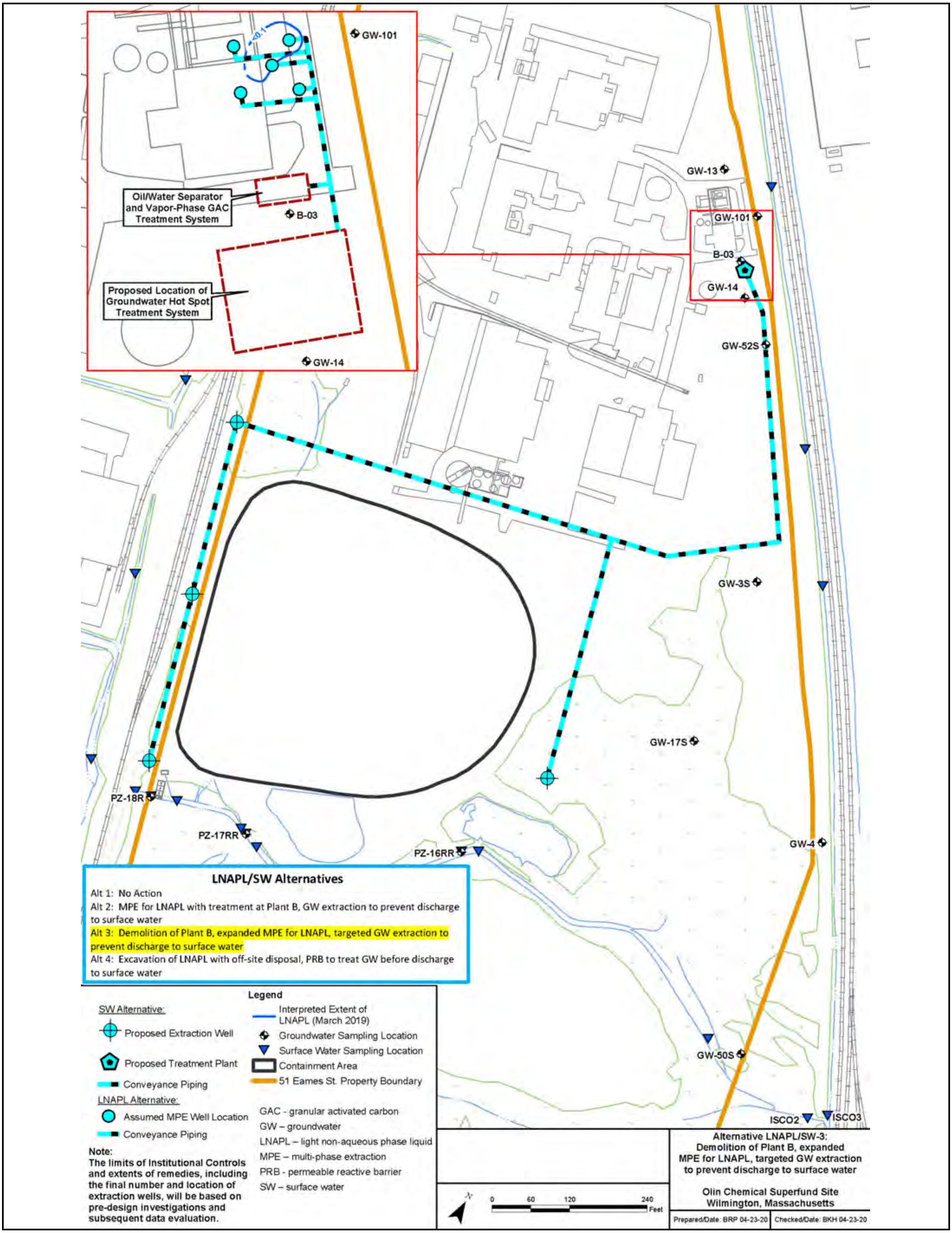

Figure 7. Conceptual plan for Alternative LNAPL/SW-3. Demolition of Plant B, expanded multi-phase extraction (MPE) for Light Non-Aqueous Phase Liquid (LNAPL), targeted groundwater extraction to prevent discharge to surface water, and on-site treatment at a new treatment system.

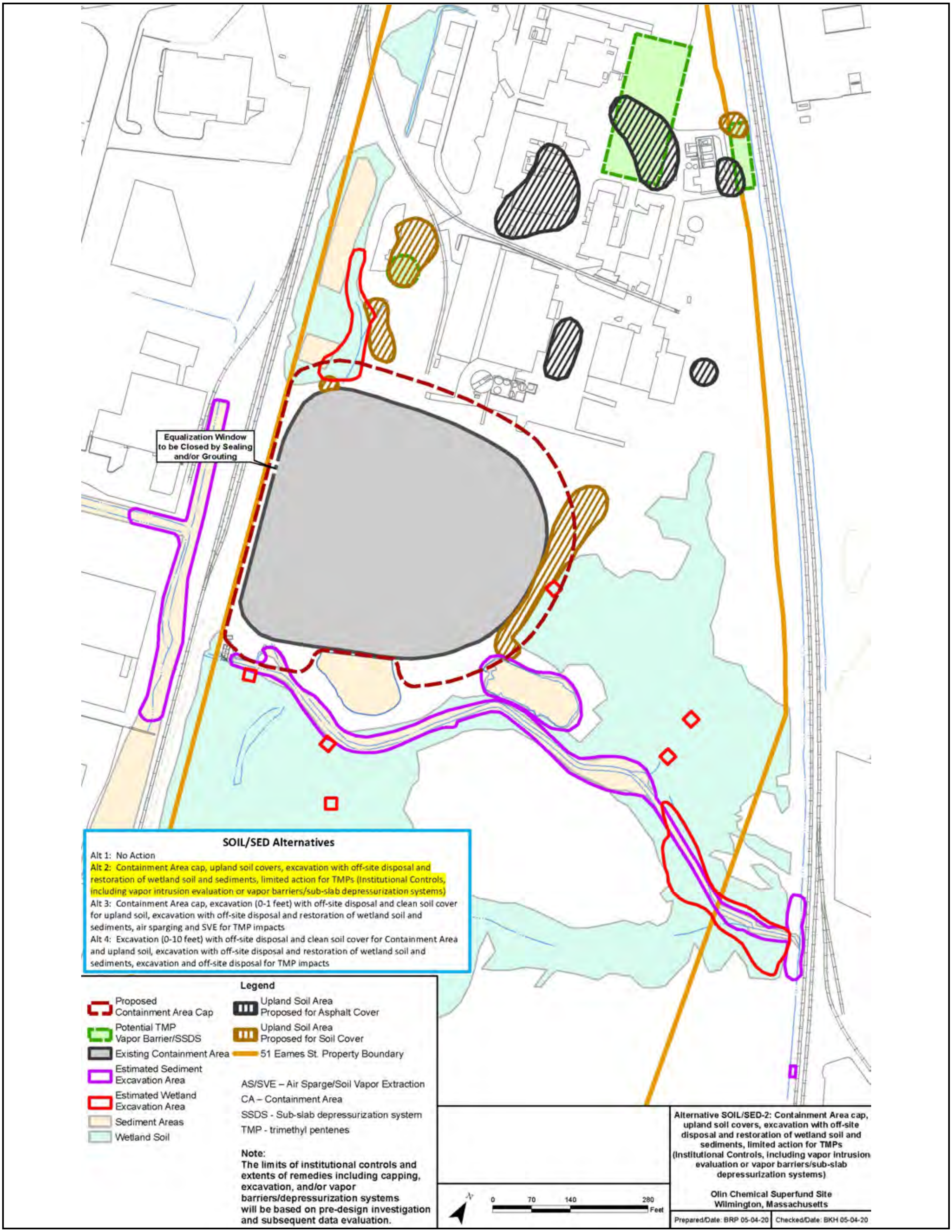

Figure 8. Conceptual plan for Alternative SOIL/SED-2. Containment Area cap, upland soil covers, excavation with off-site disposal and restoration of wetland soil and sediments, and limited action for trimethylpentenes (TMPs) – Institutional Controls, including vapor intrusion evaluations or vapor barriers/sub-slab depressurization systems.

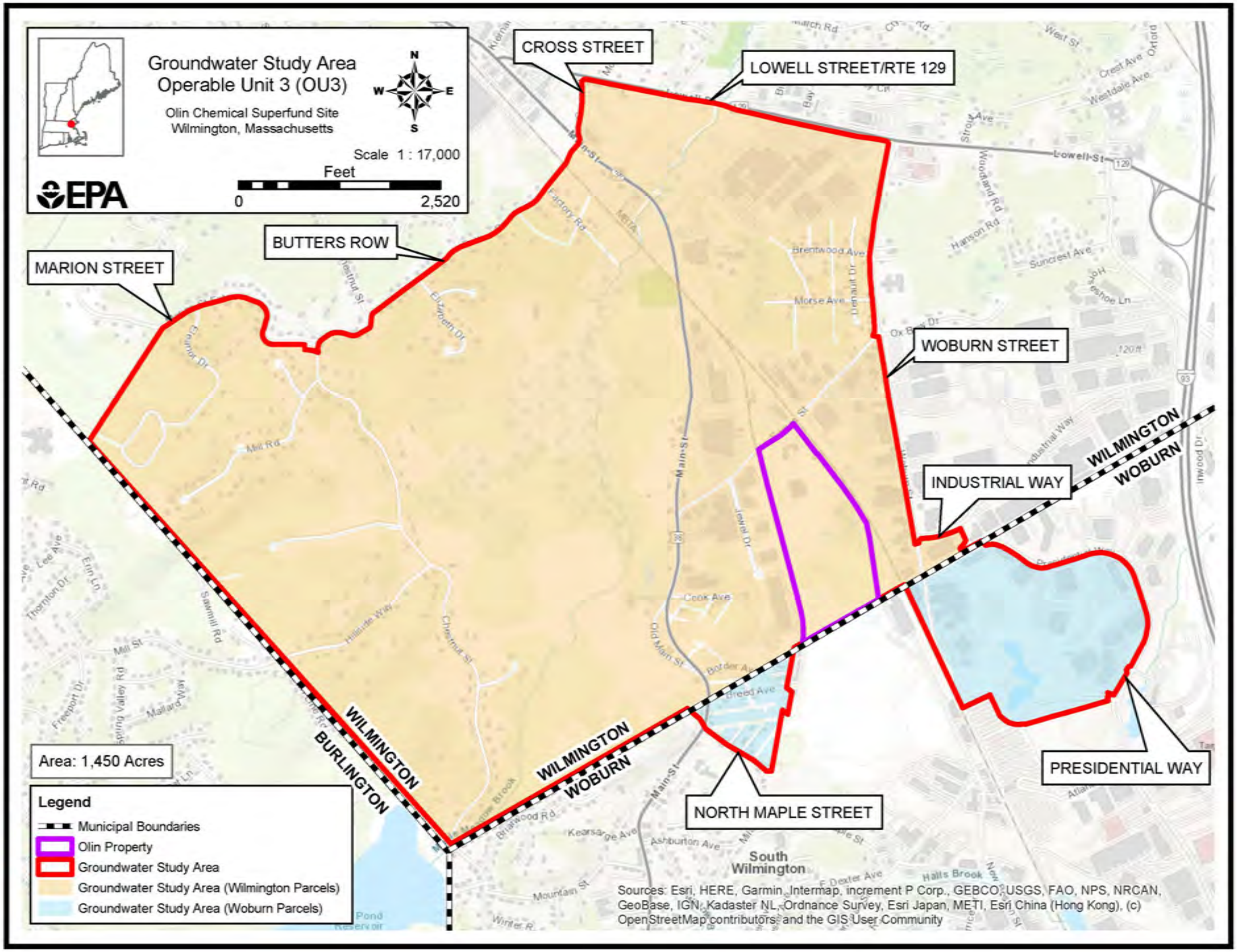

Figure 9. Operable Unit 3 (OU3) Groundwater Study Area and Extent of Groundwater Institutional Controls. Within this area, groundwater use will be restricted until final groundwater cleanup levels are selected and achieved in the final remedy for the Olin Site.